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A velocity estimation model constrained by subgrid-scale dissipation NOMA PARK, KRISHNAN MAHESH, University of Minnesota — We propose a subgrid model that estimates the subgrid velocity, while constraining the overall subgrid–scale dissipation. The motivation for the model is (i) it is not always practical to estimate filtered variables from experiment for comparison, (ii) eddy viscosity models do not account for backscatter, while models that account for backscatter can suffer from inadequate dissipation, and (iii) to explore the possibility of using LES to also predict instantaneous velocities in reasonable agreement with experiment. The modeling procedure consists of two distinct steps: in the first (predictor) step, a purely dissipative SGS model is computed. As the second (corrector) step, a similarity-type model is considered with an adjustable constant. The constant is determined by minimizing the difference of SGS dissipation between the predictor and corrector steps in the least square sense. The dynamic Smagorinsky model is used in the predictor step, and a new SGS velocity estimation model is applied to the corrector step in which the 'projected' SGS velocity is estimated on the resolved scale without extending the grid resolution. When applied to isotropic turbulence, the proposed model predicts good statistics while exhibiting realistic backscatter. Simulations of turbulent channel flow are in progress, and will be discussed.

Noma Park
University of Minnesota

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