Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Turbulent intensities in large-eddy simulation of wall-bounded flows[1] HYUNJI JANE BAE, ADRIAN LOZANO-DURAN, Stanford Univ, SANJEEB BOSE, Cascade Technologies Inc., Stanford Univ, PARVIZ MOIN, Stanford Univ — A persistent problem in wall bounded large-eddy simulations (LES) with Dirichlet no-slip boundary conditions is that the near-wall streamwise velocity fluctuations are over-predicted, while those in the wall-normal and spanwise directions are under-predicted. The problem is particularly pronounced when the near-wall region is under-resolved. The prediction of the fluctuations is known to improve for wall-modeled LES, where the no-slip boundary condition at the wall is typically replaced by Neumann and no-transpiration conditions for the wall-parallel and wall-normal velocities, respectively. However, the turbulent intensity peaks are sensitive to the grid resolution and the prediction may degrade when the grid is refined. In the present study, a physical explanation of this phenomena is offered in terms of the behavior of the near-wall streaks. We also show that further improvements are achieved by introducing a slip boundary condition with transpiration. By using a slip condition, the inner energy production peak is damped, and the blocking effect of the wall is relaxed such that the splatting of eddies at the wall is reduced. As a consequence, the slip condition provides an accurate and consistent prediction of the turbulent intensities regardless of the near-wall resolution.

[1]This work was supported by NASA under the Transformative Aeronautics Concepts Program (grant no. UNIX15AU93A).

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Date submitted: 11 Sep 2017 Electronic form version 1.4