Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Large-eddy simulation of separation-reattachment of a flat-plate turbulent boundary layer WAN CHENG, DALE PULLIN, California Institute of Technology, Pasadena, CA, RAVI SAMTANEY, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia — We describe large-eddy simulations (LES) of turbulent boundary-layer flow over a flat plate at high Reynolds number in the presence of three-dimensional flow separation. The stretched-vortex subgrid-scale model is used in the bulk of the flow domain combined with a wall-model that is a two-dimensional extension of that described by Chung and Pullin [J. Fluid Mech., 631, 281-309, 2009]. Wall-normal averaging of the wall-parallel, stream-wise momentum equations combined with local inner scaling for the resolved-scale velocity gives an ordinary differential equation describing the wall shear-stress vector at each wall point. Together with a specification of a slip velocity at a raised, wall-parallel plane, this provides a boundary condition for the outer LES that allows local backflow. The present LES is motivated by experiments on flows exhibiting separation induced by the response of a turbulent boundary layer to an adverse-favorable pressure-gradient profile. Detailed discussion of detachment and reattachment of the separation bubble will be presented.

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Date submitted: 30 Jul 2014 Electronic form version 1.4