Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Investigation of a Wall Shear-Stress Inner-Outer Interaction Model for Large-Eddy Simulations WILLIAM SIDEBOTTOM, OLIVIER CABRIT, IVAN MARUSIC, The University of Melbourne, CHARLES MENEVEAU, Johns Hopkins University, ANDREW OOI, The University of Melbourne, DAVID JONES, Defence Science and Technology Organisation — The very small turbulent motions in the thin layer of fluid immediately adjacent to a solid surface in a turbulent boundary layer make it difficult to effectively scrutinise the near-wall dynamics with physical and numerical experiments. These near-wall turbulent motions, and the no-slip condition, directly affect the tangential stress at the surface–the wall shear-stress. This study investigates a new wall-model for large-eddy simulations capable of predicting the fluctuating wall shear-stress from a large-scale velocity input, without the need to fully resolve the smallest structures in the flow. The model is based on the spectral structure of the turbulent boundary layer and the interaction between large-scale events in the logarithmic layer and small-scale events near the wall. Various methods have previously been used to predict the mean wall shear-stress with sufficient accuracy. There are, however, very few models available to predict the fluctuating component. Results from the new wall-model show that it has only a small effect on mean quantities, such as the skin-friction coefficient, but is able to resolve more of the wall shear-stress variance than a "standard" wall-model.

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Date submitted: 01 Aug 2014 Electronic form version 1.4