

Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Large eddy simulation study of the logarithmic law for high-order moments in turbulent boundary layers¹ RICHARD STEVENS, MICHAEL WILCZEK, CHARLES MENEVEAU, Johns Hopkins University — Analyzing highly resolved experimental data, recently generalized log-laws have been observed by Meneveau and Marusic (JFM 719, R1 (2013)) for higher-order even moments of the streamwise velocity fluctuations u' . These observations provide new and robust data in canonical boundary layers that can be compared to the output of Large Eddy Simulation models. To utilize the new data for this purpose, we have performed large eddy simulations at various resolutions and with different sub-grid models (Smagorinsky and scale-dependent Lagrangian dynamic model). In agreement with the experimental data, the higher-order generalizations of the log-law are also observed in the LES results. But since large eddy simulations do not resolve the sub-grid contributions, we furthermore discuss the possibility of an a-posteriori correction of the statistical moments based on quasi-Gaussian assumptions for the statistics of the sub-grid contributions. We find that, while the corrections are small in the bulk of the flow, they can reach significant amplitudes in the near-wall region.

¹“Fellowships for Young Energy Scientists” (YES!) of FOM, DFG funding WI 3544/2-1, and US National Science Foundation grants numbers CBET 1133800 and OISE 1243482.

Richard Stevens
Johns Hopkins University

Date submitted: 31 Jul 2013

Electronic form version 1.4