Weekly CEAFM Seminar: Spring 2016

JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

Winner of the 2015 Corrsin-Kovasznay Outstanding Paper Award

Date: **Friday, March 25, 2016**

Time: 11:00 AM

Location: Gilman Hall # 50

Speaker: **Dr. Richard J.A.M. Stevens** (University of Twente)

Title: ***"Challenging the Large Eddy Simulation Technique for Turbulent Wall-Bounded Flow with Advanced a Posteriori Tests"***

Abstract

The logarithmic law for the mean velocity in turbulent boundary layers has long provided a valuable and robust reference for comparison with theories, models and large-eddy simulations (LES) of wall-bounded turbulence. More recently, analysis of high-Reynolds-number experimental boundary-layer data has shown that also the variance and higher-order moments of the streamwise velocity fluctuations u0C display logarithmic laws. Such experimental observations motivate the question whether LES can accurately reproduce the variance and the higher-order moments, in particular their logarithmic dependency on distance to the wall. In this study we perform LES of very high-Reynolds-number wall-modelled channel flow and focus on profiles of variance and higher-order moments of the streamwise velocity fluctuations. In agreement with the experimental data, we observe an approximately logarithmic law for the variance in the LES, with a 'Townsend–Perry' constant of A_1 \approx. 1.25. The LES also yields approximate logarithmic laws for the higher-order moments of the streamwise velocity. Good agreement is found between Ap, the generalized 'Townsend–Perry' constants for moments of order 2p, from experiments and simulations. Both are indicative of sub-Gaussian behavior of the streamwise velocity fluctuations. The near-wall behavior of the variance, the ranges of validity of the logarithmic law and in particular possible dependencies on characteristic length scales such as the roughness length z_0, the LES grid scale \Delta, and subgrid scale mixing length Cs\Delta are examined. We also present LES results on moments of spanwise and wall-normal fluctuations of velocity.