JOHNS HOPKINS

Center for Environmental & Applied Fluid Mechanics

Weekly CEAFM Seminar: Spring 2012

Friday, March 2, 2012

11:00 a.m. – 12:00 p.m.

Gilman 50 (Marjorie M. Fisher Hall)

"Experimental Investigation of Roughness Effect on Turbulence: From Near-Wall to Outer-layer"

Presented by

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Winner of the 2011 Corrsin-Kovasznay Outstanding Paper Award

Abstract: For the turbulent flow over rough surfaces, two questions are of fundamental interest. One is how the roughness characteristics influence local turbulence, and then the other is how far this roughness effect extends above the surface. Due to the lack of near-wall measurement data, the physical mechanism related to these questions are not well-understood. Applying particle image velocimetry (PIV) in a channel with working fluid of the same optic properties as the roughness, we are able to resolve turbulence and corresponding statistics very close to the surface. The results show a recurrent generation of coherent structures with dominant roughness scales above the wall, causing the spatial variability of local turbulence statistics. The interaction among these structures leads to the upsurge of turbulent dissipation and large subgrid-scale energy transfer, which limit the roughness effect on Reynolds stresses to a region scaled with roughness height above the wall.

Nevertheless, large-scale structures from the outer-part of the channel lift up near-wall roughness-scale eddies to a much higher elevation, resulting in elevated local dissipation and spectral bumps at the roughness-scale range of turbulent energy spectra.