

Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Turbulent boundary layer measurements over high-porosity surfaces CHRISTOPH EFSTATHIOU, MITUL LUHAR, Univ of Southern California — Porous surfaces are ubiquitous across a variety of turbulent boundary layer flows of scientific and engineering interest. While turbulent flows over smooth and rough walls have been studied extensively, experimental measurements over porous walls have thus far focused on packed beds, which are limited in porosity ($\Phi = 0.3 - 0.5$) by their geometry. The current project seeks to address this limitation. A two-component laser doppler velocimeter (LDV) is used to generate velocity measurements in turbulent boundary layer flows over commercially available reticulated foams and 3D-printed porous media at Reynolds number $Re_\theta \approx 3000 - 4000$. Smooth wall profiles for mean and turbulent quantities are compared to data over substrates with porosity $\Phi > 0.8$ and average pore sizes in the range 0.4-2.5mm (corresponding to $\approx 8 - 50$ viscous units). Previous analytical and simulation efforts indicate that the effects of porous substrates on boundary layer flows depend on a modified Reynolds number defined using the length scale $\sqrt{\kappa}$, where κ is substrate permeability. A custom permeameter is currently being developed to estimate κ for the substrates tested in the boundary layer experiments.

Christoph Efstathiou
Univ of Southern California

Date submitted: 30 Jul 2016

Electronic form version 1.4