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Physical modeling of the atmospheric boundary layer in the UNH Flow Physics Facility GREGORY TAYLOR-POWER, STEPHANIE GILOOLY, MARTIN WOSNIK, JOE KLEWICKI, JOHN TURNER, University of New Hampshire — The Flow Physics Facility (FPF) at UNH has test section dimensions W=6.0m, H=2.7m, L=72m. It can achieve high Reynolds number boundary layers, enabling turbulent boundary layer, wind energy and wind engineering research with exceptional spatial and temporal instrument resolution. We examined the FPF's ability to experimentally simulate different types of the atmospheric boundary layer (ABL) using upstream roughness arrays. The American Society for Civil Engineers defines standards for simulating ABLs for different terrain types, from open sea to dense city areas (ASCE 49-12). The standards require the boundary layer to match a power law shape, roughness height, and power spectral density criteria. Each boundary layer type has a corresponding power law exponent and roughness height. The exponent and roughness height both increase with increasing roughness. A suburban boundary layer was chosen for simulation and a roughness element fetch was created. Several fetch lengths were experimented with and the resulting boundary layers were measured and compared to standards in ASCE 49-12: Wind Tunnel Testing for Buildings and Other Structures. Pitot tube and hot wire anemometers were used to measure average and fluctuating flow characteristics. Velocity profiles, turbulence intensity and velocity spectra were found to compare favorably.

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