

Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Wind Tunnel Simulation of the Atmospheric Boundary Layer¹

TRISTEN HOHMAN, ALEXANDER SMITS, LUIGI MARTINELLI, Princeton University — To simulate the interaction of large Vertical Axis Wind Turbines (VAWT) with the Atmospheric Boundary Layer (ABL) in the laboratory, we implement a variant of Counihan's technique in which a combination of a castellated barrier, elliptical vortex generators, and floor roughness elements is used to create an artificial ABL profile in a standard closed loop wind tunnel. We report hotwire measurements in a plane normal to the flow direction at various downstream positions and free stream velocities to examine the development and formation of the artificial ABL. It was found possible to generate a boundary layer at $Re_\theta \sim 10^6$, with a mean velocity that followed the 1/7 power law of a neutral ABL over rural terrain and longitudinal turbulence intensities and power spectra that compare well with the data obtained by Hultmark in 2010 for high Reynolds number flat plate turbulent boundary layers.

¹Supported by Hopewell Wind Power Ltd., and the Princeton Grand Challenges Program.

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Date submitted: 03 Aug 2012

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