

Abstract Submitted
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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 [Counihan 1969] 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. To examine the development and formation of the artificial ABL hotwire and SPIV measurements were taken at various downstream locations with changes in wall roughness, wall type, and vortex generator arrangements. 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 for high Reynolds number flat plate turbulent boundary layers [Hultmark et al. 2010].

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