Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Turbulent properties of a wind-turbine wake developed in a boundary layer flow LEONARDO CHAMORRO, FERNANDO PORTE-AGEL, University of Minnesota — Wind turbine wake characteristics are expected to depend on the incoming atmospheric boundary layer flow statistics (e.g., mean velocity distribution, turbulent stresses and turbulent fluxes). Atmospheric stability is also expected to affect the structure of a turbine wake. In this study, results are presented from wind tunnel experiments carried out at the St. Anthony Falls Laboratory atmospheric boundary layer wind tunnel using a model wind turbine placed inside the boundary layer developed over a smooth and rough surface. The structure and behavior of the wind turbine wake are studied also under different conditions of thermal stratification. Thermal stratification levels in the boundary layer were achieved by controlling the temperature of both the tunnel floor and the air flow. A triple-wire (x-wire and cold wire) anemometer and Particle Image Velocimetry (PIV) were used to characterize the turbulent wake downwind of the turbine at different locations. This study provides valuable information about the spatial characteristics of the structure of wind-turbine wakes. This information is being used to test and guide the development of improved parameterizations of wind turbines in high-resolution numerical models, such as large-eddy simulations (LES).

Leonardo Chamorro
University of Minnesota

Date submitted: 11 Aug 2009 Electronic form version 1.4