

Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Wind turbine wake meandering at the laboratory and field scales

MICHAEL HEISEL, MIRKO MUSA, JIARONG HONG, MICHELE GUALA, St Anthony Falls Laboratory, University of Minnesota - Twin Cities — Flow measurements were collected in the wake of the utility-scale (2.5MW) Eolos wind turbine using a ground-based light detection and ranging (LiDAR) wind profiler to identify the characteristics of wake meandering at the field scale. The investigation seeks to establish the influence of scale and atmospheric turbulence on wake meandering, which has been observed to leave a strong spectral signature on laboratory measurements in wind tunnel and channel flows. The experimental data include multiple test periods at various downstream distances within the turbine wake. Inflow conditions were assessed using a meteorological tower equipped with sonic anemometers. Additionally, an experiment was conducted in the Saint Anthony Falls Laboratory atmospheric boundary layer wind tunnel to provide a direct comparison for the utility-scale results and to reaffirm the findings of previous laboratory-scale investigations. Estimates of the wake and inflow one-dimensional velocity spectra were compared to determine whether wake meandering characteristics are present at both scales. An empirical correction to the velocity spectra of the LiDAR and a few options to extract a more local velocity signal are discussed to compensate for the inherent limitations of LiDAR in capturing turbulent fluctuations.

Michael Heisel
St Anthony Falls Laboratory, University of Minnesota - Twin Cities

Date submitted: 27 Jul 2016

Electronic form version 1.4