

Abstract Submitted  
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**Velocity field and coherent structures in the near wake of a utility-scale wind turbine**<sup>1</sup> JIARONG HONG, TEJA DASARI, YUE WU, YUN LIU, University of Minnesota — Super-large-scale particle image velocity (SLPIV) and the associated flow visualization technique using natural snowfall have been shown as an effective tool to probe turbulent velocity field and coherent structures around utility-scale wind turbines (Hong et al. *Nature Comm.* 2014). Here we present a follow-up study using the data collected during multiple deployments from 2014 to 2016 around the 2.5 MW turbine at EOLOS field station. The data include SLPIV measurements in the near wake of the turbine in a field of view of  $\sim 120$  m (height)  $\times$  60 m (width), and the visualization of tip vortex behavior near the bottom blade tip over a broad range of turbine operational conditions. SLPIV results indicate a highly intermittent flow field in the near wake, consisting of both intense wake expansion and contraction events. Such intermittent states of the near wake are shown to be influenced by both the incoming wind conditions and the turbine operation. The visualization of tip vortex behavior demonstrates the presence of the state of consistent vortex formation as well as various types of disturbed vortex states. The occurrence of these states is statistically analyzed and is shown to be correlated with turbine operational and response parameters under different field conditions.

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