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Investigation on the near-wake flow structures of a utility-scale wind turbine using snowflake based flow visualization[1] TEJA DASARI , MOSTAFA TOLOUI, MICHELE GUALA, JIARONG HONG, University of Minnesota — Super-large-scale particle image velocimetry and flow visualization techniques using natural snow particles have been shown as an effective tool to probe the structure of the flow around full-scale wind turbines (Hong et al. *Nature Comm.* 2014). Here we present a follow-up study based on the data collected during a deployment around the 2.5 MW wind turbine at EOLOS Wind Energy Research Station on April, 4^{th}, 2014. The dataset includes the snow visualization of flow fields from different perspectives in the near wake of the turbine. The motions of the dominant coherent structures including tip, blade root, hub and tower vortices, represented by the snow voids, are examined with the objective of quantifying and correlating their behavior with the meteorological and turbine operating conditions. Some preliminary studies on flow-structure interaction are also performed by correlating the data from strain gauges, accelerometers mounted on the turbine blades, with the flow measurements. The statistical analysis of the motions of blade induced vortices shows a clear impact of atmospheric turbulence and vortex interaction on flow development in the near wake. The result further indicates a strong connection between near-wake vorticity field, turbine operation and structure deformations.

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Jiarong Hong
University of Minnesota

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