Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Analysis of near-surface relative humidity in a wind turbine array boundary layer using an instrumented unmanned aerial system and large-eddy simulation KEVIN ADKINS, OUMNIA ELFAJRI, ADRIAN SESCU, Mississippi State University — Simulation and modeling have shown that wind farms have an impact on the near-surface atmospheric boundary layer (ABL) as turbulent wakes generated by the turbines enhance vertical mixing. These changes alter downstream atmospheric properties. With a large portion of wind farms hosted within an agricultural context, changes to the environment can potentially have secondary impacts such as to the productivity of crops. With the exception of a few observational data sets that focus on the impact to near-surface temperature, little to no observational evidence exists. These few studies also lack high spatial resolution due to their use of a limited number of meteorological towers or remote sensing techniques. This study utilizes an instrumented small unmanned aerial system (sUAS) to gather in-situ field measurements from two Midwest wind farms, focusing on the impact that large utility-scale wind turbines have on relative humidity. Results are also compared to numerical experiments conducted using large eddy simulation (LES). Wind turbines are found to differentially alter the relative humidity in the downstream, spanwise and vertical directions under a variety of atmospheric stability conditions.

Kevin Adkins
Mississippi State University

Date submitted: 13 Sep 2016 Electronic form version 1.4