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Development of a Scaled Smart Wind Farm SUHAS POL, AMELIA TAYLOR, DALTON MCKEON, LUCIANO CASTILLO, ISAIAS PEREZ, REN BEIBEI, JIAN SHENG, CARSTEN WESTERGAARD, AKSAK BURAK, GUILLERMO ARAYA, FAZLE HUSSAIN, Texas Texas University —
A model wind farm consisting of 3X5 horizontal axis turbines with a rotor diameter of 4 m (to be expanded to 5X20 turbines of 2m diameter) is being developed on TTU campus. Real field turbine wake evolution and interactions will be studied by employing particle image velocimetry. A 10m tower upstream of the wind farm as well as a 200m tower located 500m from the site will be used to characterize the atmospheric condition and its influence on the wake evolution. Of particular interest is the role of coherent structures in the atmosphere and the wake on the downward transport of overhead momentum - hence the effectiveness of the wind farm. From the recorded data episodes of stable, unstable and neutral atmosphere will be conditionally sampled to understand the effect of atmospheric stability on wind farm dynamics. The effect of various turbine-turbine separation and orientation on the downward momentum transport will be studied – quite feasible since the turbine models are portable. In addition to aerodynamic studies the facility we will also test control algorithms.

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