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Flow development comparison in two-bladed and three-bladed model wind turbine arrays C. DALTON MCKEON, JONATHAN SULLIVAN, Texas Tech University, ELIZABETH CAMP, MATTHEW MELIUS, DOMINIC DELUCIA, RAUL BAYOAN CAL, Portland State University, LUCIANO CASTILLO, Texas Tech University and the National Wind Resource Center —
Vertical entrainment of energy through turbulent structures is compared between two-bladed and three-bladed model wind turbine arrays. A wind tunnel study under neutrally stratified conditions has been performed to compare the differences in large-scale structures of energy fluxes in two 3×4 arrays. Both arrays have three turbines with 3D spacing in the spanwise direction and four turbines with 6D spacing in the streamwise direction. The rotor diameter for both is 12 cm. The same mean velocity at hub height is maintained for both arrays. The power coefficient for both models is matched, resulting in different tip speed ratios. Consequently, both arrays of turbines are extracting energy from the flow at the same rate, which results in the identification of differences in energy fluxes due to the distinct number of blades on the rotor. Velocity data is collected via stereoscopic PIV; planes are located along the centerline of the array and are parallel with the streamwise direction. Profiles of mean velocity, Reynolds stresses, energy flux, and energy dissipation are generated. These profiles are used to compare the mechanisms of energy exchange in the two-bladed and three-bladed arrays.

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None

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