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The effect of two-bladed and three-bladed wind turbine rotors on fluxes of kinetic energy DALTON MCKEON, ANDREW NEWMAN, Texas Tech University, MATTHEW MELIUS, RAUL CAL, Portland State University, LUCIANO CASTILLO, Texas Tech University — As energy is extracted by wind turbines in an array, the main mechanism entraining energy into the flow within the array has been shown to be turbulent kinetic energy flux. Experiments showing this relationship have utilized three-bladed rotors. The goal of this study is to describe fluxes of kinetic energy in arrays utilizing two-bladed and three-bladed rotors. In a wind tunnel, two 3 X 4 arrays of model wind turbines were exposed to neutrally stratified conditions, with one array using two-bladed rotors and the other using three-bladed rotors. Both arrays had three turbines with 3D spacing in the spanwise direction and four turbines with 6D spacing in the streamwise direction. Each rotor had a diameter of 12 cm. The power coefficient was matched so that the non-dimensional rate of energy extraction was the same for both arrays. Data was collected along the centerline of both arrays using PIV with vertical data planes parallel to the streamwise direction. A control volume bounded by the rotor top tip and bottom tip is considered and fluxes of kinetic energy are compared for two-bladed and three-bladed arrays. Preliminary results show similar trends for the fluxes in both arrays, but no direct scaling was found, indicating a more complicated dependence on the number of blades.

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