Abstract Submitted
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Statistical and quadrant-hole analysis of the turbulence characteristics in a 3 x 3 wind turbine array boundary layer[1] MAX GIBSON, Portland State University (PSU), HYUNG-SUK KANG, Johns Hopkins University (JHU), CHARLES MENEVEAU, JHU, RAUL BAYOAN CAL, PSU — Data from a wind-tunnel experiment on the flow within a 3 x 3 array of lightly loaded wind turbine models operating inside a turbulent boundary layer over a rough surface are analyzed. The data are acquired using X hot-wire anemometry and the focus of the analysis is on the possible differences of the flow structures above and below the canopy of wind turbines. Here this question is addressed using quadrant analysis. Conditional averages of turbulent dissipation (a 1-D surrogate) at various heights at 5 diameters downstream is performed for each of the 4 quadrants as well as different "hole-sizes." The results imply significantly less inter-scale correlations in the low-shear region at the bottom of the wind turbine wake than at other wake locations. Inter-scale correlations above and below the wake are also significantly greater than at that low-shear region. Spectral analysis is performed to determine which scales are mostly responsible for the various levels of Reynolds stresses as functions of position in the wind turbine wake.

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