Abstract Submitted
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Turbulence effects on a full-scale 2.5 MW horizontal axis wind turbine[1] LEONARDO CHAMORRO, SEUNG-JAE LEE, DAVID OLSEN, CHRIS MILLIREN, JEFF MARR, ROGER ARNDT, FOTIS SOTIROPOULOS, University of Minnesota — Power fluctuations and fatigue loads are among the most significant problems that wind turbines face throughout their lifetime. Turbulence is the common driving mechanism that triggers instabilities on these quantities. We investigate the complex response of a full-scale 2.5 MW wind turbine under nearly neutral thermal stratification. The study is performed in the EOLOS Wind Energy Research Field Station of the University of Minnesota. An instrumented 130 meter meteorological tower located upstream of a Clipper Liberty C96 wind turbine is used to characterize the turbulent flow and atmospheric conditions right upstream of the wind turbine. High resolution and synchronous measurements of the wind velocity, turbine power and strain at the tower foundation are used to determine the scale-to-scale interaction between flow and the wind turbine. The structure of the fluctuating turbine power and instantaneous stresses are studied in detail. Important insights about the role of turbulent and coherent motions as well as strong intermittent gusts will be discussed.

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