Abstract Submitted
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Wind tunnel measurements of a large wind farm model approaching the infinite wind farm regime[1] JULIAAN BOSSUYT, KU Leuven and Johns Hopkins University, MICHAEL HOWLAND, CHARLES MENEVEAU, Johns Hopkins University, JOHAN MEYERS, KU Leuven — A scaled wind farm, with 100 porous disk models of wind turbines, is used to study the effect of wind farm layout on the wind farm power output and its variability, in a wind tunnel study. The wind farm consists of 20 rows and 5 columns. The porous disk models have a diameter of $0.03m$ and are instrumented with strain gages to measure the thrust force, as a surrogate for wind turbine power output. The frequency response of the measurements goes up to the natural frequency of the models and allows studying the spatio-temporal characteristics of the power output for different layouts. A variety of layouts are considered by shifting the individual rows in the spanwise direction. The reference layout has a regular streamwise spacing of $S_x/D = 7$ and a spanwise spacing of $S_y/D = 5$. The parameter space is further expanded by considering layouts with an uneven streamwise spacing: $S_x/D = 3.5\&10.5$ and $S_x/D = 1.5\&12.5$. We study how the mean row power changes as a function of wind farm layout and investigate the appearance of an asymptotic limiting behavior as previously described in the literature by application of the top-down model for the spatially averaged wind farm - boundary layer interaction.

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