Abstract Submitted
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Effect of the tip speed ratio in the power production of aligned wind turbines[1] KENNETH CARRASQUILLO, CHRISTIAN SANTONI, MARIO ROTEA, YAOYU LI, STEFANO LEONARDI, The University of Texas at Dallas — The increased demand for wind energy had led to a constant increase in the size of wind turbines and subsequently of the wind farms. A drawback of using large arrays of wind turbines is the decrease in efficiency due to the wake interference. For example, the second row of turbines extracts about 15% less power than the first row. Previous studies indicated that the power production of the entire wind farm is not maximized if the turbines work at their optimum tip speed ratio (TSR). In fact, reducing the TSR on the upwind turbines with respect to an optimum value, the momentum deficit decreases and the downwind turbines power production increases. Although the power production on the upwind turbines decreases, the power production of the entire wind plant may increase. Large Eddy Simulations of the turbulent flow over three NREL5MW aligned turbines have been performed. The most downwind turbine is kept at maximum power production with TSR=7.5, while the TSR of the other two turbines is varied. The effect of the TSR on power production and its fluctuations will be discussed. The UTDWF code is used to perform the simulations, which is based on a finite difference scheme with the Line Actuator to model the turbine blades and the Immersed Boundary Method for the tower and nacelle.

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