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The Restricted Non Linear - LES approach to simulations of large wind farms[1] JOEL BRETHEIM, CHARLES MENEVEAU, DENNICE GAYME, Johns Hopkins University — The restricted nonlinear (RNL) model has recently proven useful in numerical investigations of wall-bounded turbulent flows due to the much smaller number of streamwise Fourier modes required to describe the RNL dynamics. In this work, we extend a recently developed large eddy simulation framework for the RNL system (RNL-LES) to the application of wind farms. This new simulation framework exploits the simplified dynamics and computational tractability of the RNL-LES system to provide a computationally inexpensive tool for conducting studies of wind farms over a wide range of parameter variations; such studies may be cost-prohibitive for traditional wind farm simulation tools (e.g. LES). We report simulation results for different configurations of arrays of vertically staggered wind turbines (modeled as actuator disks). We also consider the effects on total farm power production and quantify various terms in the budget of mean kinetic energy, with special emphasis on vertical flux of mean kinetic energy.

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