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Implementation of wind turbine parameterizations in a mesoscale-LES nested model framework FOTINI CHOW, NIKOLA MARJANOVIC, University of California, Berkeley, JEFFREY MIROCHA, Lawrence Livermore National Laboratory — Wind turbine performance depends on weather conditions, local topography, and wind turbine spacing, among other factors. Atmospheric simulations can be used to predict wind energy production at increasingly higher resolutions. Turbine models placed within such simulations can be used to investigate turbine operation and performance. This work describes the implementation of generalized actuator disk (GAD) and line (GAL) models into the Weather Research and Forecasting (WRF) mesoscale atmospheric model. WRF can be used in a grid nested configuration starting from the mesoscale ($\sim$10 km resolution) and ending with fine scale resolutions ($\sim$1-10 m) suitable for large-eddy simulations (LES). At LES scales it becomes possible to resolve both the thrust and torque forces generated on turbines and imparted to the atmosphere using GAD and GAL models. Both models include real-time yaw and pitch control to respond to changing flow conditions. Here, the GAD and GAL are tested for idealized and real model configurations and compared to data from a wind farm. Comparisons are also made that help determine the importance of turbine blade tilt away from the tower and the inclusion of tower and turbine hub drag effects.

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