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Forecasting the weather
- ensemble techniques
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A large-eddy simulation study of wake effects in an operational wind farm

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A recently proposed large-eddy simulation (LES) framework is used to simulate atmospheric boundary layer (ABL) flow through an operational wind farm consisting of Siemens SWT-2.3-93 wind turbines. Simulation results are compared with wind velocity measurements collected using two SODARs that were placed within a group of five turbines. Three types of models are used to parameterize the turbine-induced forces: a standard actuator-disk model without rotation (ADM-NR), an actuator-disk model with rotation (ADM-R), and an actuator-line model (ALM). Simulation results show that the ADM-R and the ALM are capable of delivering accurate mean velocity profiles in the wake, with ADM-NR slightly under-estimating the velocity deficit in the near wake region. The turbine power prediction simulated with both ADM-R and ALM are able to capture reductions in power associated with turbine wakes. Consistent with the underestimation of the velocity deficit, the ADM-NR is found to underestimate the power reduction in turbines operating in wakes of other turbines.