Abstract Submitted
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Proactive monitoring of an onshore wind farm through lidar measurements, SCADA data and a data-driven RANS solver[1] GIACOMO VALERIO IUNGO, UT Dallas, SIMONE CAMARRI, University of Pisa, UMBERTO CIRI, SAID EL-ASHA, STEFANO LEONARDI, MARIO A ROTEA, VIGNESH SANTHANAGOPALAN, UT Dallas, FRANCESCO VIOLA, EPFL, LU ZHAN, UT Dallas — Site conditions, such as topography and local climate, as well as wind farm layout strongly affect performance of a wind power plant. Therefore, predictions of wake interactions and their effects on power production still remain a great challenge in wind energy. For this study, an onshore wind turbine array was monitored through lidar measurements, SCADA and met-tower data. Power losses due to wake interactions were estimated to be approximately 4% and 2% of the total power production under stable and convective conditions, respectively. This dataset was then leveraged for the calibration of a data driven RANS (DDRANS) solver, which is a compelling tool for prediction of wind turbine wakes and power production. DDRANS is characterized by a computational cost as low as that for engineering wake models, and adequate accuracy achieved through data-driven tuning of the turbulence closure model. DDRANS is based on a parabolic formulation, axisymmetry and boundary layer approximations, which allow achieving low computational costs. The turbulence closure model consists in a mixing length model, which is optimally calibrated with the experimental dataset. Assessment of DDRANS is then performed through lidar and SCADA data for different atmospheric conditions.

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