Abstract Submitted
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3D-PTV around Operational Wind Turbines IAN BROWNSTEIN, JOHN DABIRI, Stanford — Laboratory studies and numerical simulations of wind turbines are typically constrained in how they can inform operational turbine behavior. Laboratory experiments are usually unable to match both pertinent parameters of full-scale wind turbines, the Reynolds number (Re) and tip speed ratio, using scaled-down models. Additionally, numerical simulations of the flow around wind turbines are constrained by the large domain size and high Re that need to be simulated. When these simulations are preformed, turbine geometry is typically simplified resulting in flow structures near the rotor not being well resolved. In order to bypass these limitations, a quantitative flow visualization method was developed to take in situ measurements of the flow around wind turbines at the Field Laboratory for Optimized Wind Energy (FLOWE) in Lancaster, CA. The apparatus constructed was able to seed an approximately 9m x 9m x 5m volume in the wake of the turbine using artificial snow. Quantitative measurements were obtained by tracking the evolution of the artificial snow using a four camera setup. The methodology for calibrating and collecting data, as well as preliminary results detailing the flow around a 2kW vertical-axis wind turbine (VAWT), will be presented.

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