Abstract Submitted
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Dynamic Gaussian wake meandering in a restricted nonlinear simulation framework[1] JOEL BRETHEIM, Johns Hopkins University, FERNANDO PORTE-AGEL, Ecole Polytechnique Federale de Lausanne, DENNICE GAYME, CHARLES MENEVEAU, Johns Hopkins University — Wake meandering can significantly impact the performance of large-scale wind farms. Simplified wake expansion (e.g., Jensen/PARK) models, which are commonly used in industry, lead to accurate predictions of certain wind farm performance characteristics (e.g., time- and row-averaged total power output). However, they are unable to capture certain temporal phenomena such as wake meandering, which can have profound effects on both power output and turbine loading. We explore a dynamic wake modeling framework based on the approach proposed by Larsen et al. (Wind Energy 11, 2008) whereby turbine "wake elements" are treated as passive tracers and advected by an averaged streamwise flow. Our wake elements are treated as Gaussian velocity deficit profiles (Bastankhah and Porte-Agel, Renew. Energy 70, 2014). A restricted nonlinear (RNL) model is used to capture the turbulent velocity fluctuations that are critical to the wake meandering phenomenon. The RNL system, which has been used in prior wall-turbulence studies, provides a computationally affordable way to model atmospheric turbulence, making it more reasonable for use in engineering models than the more accurate but computationally intensive approaches like large-eddy simulation.

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