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NEWS | NOVEMBER 08 2022

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Alane Lim

Scilight 2022, 461106 (2022)
https://doi.org/10.1063/10.0015048

AIP Publishing

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8 November 2022

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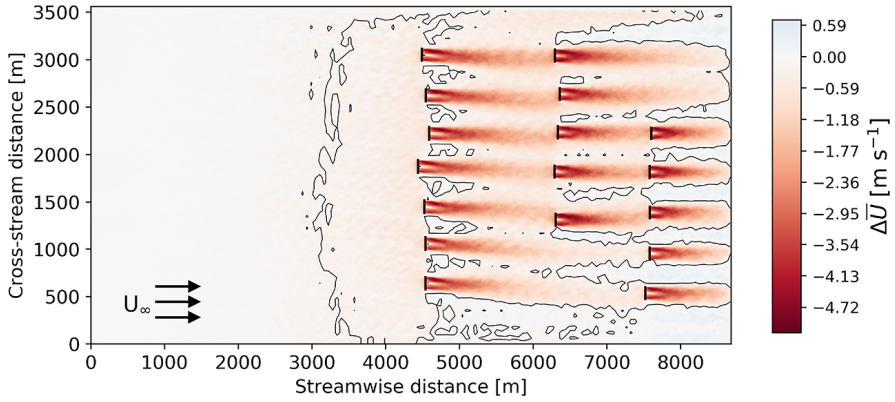
Simulations distinguish contributions from wind plant blockages and topography heterogeneities.



Though power plants fueled by wind, or wind plants, can help us reach a more sustainable future, scientists are still uncertain about their two-way interaction with the atmosphere, which can affect flows in the plant. One area of research interest is how the atmosphere can decelerate wind speeds upstream of the wind plant through a phenomenon known as wind farm blockage. Using simulations, Sanchez Gomez et al. highlighted the difficulties of measuring wind plant blockage in simple terrain.

In the atmosphere around a wind plant in central Oklahoma, the upstream deceleration was one order of magnitude smaller than deceleration in the plant itself. By simulating the wind flow, the team found that flow heterogeneities due to topography should also be quantified when measuring wind blockage in field experiments.

“Flow heterogeneities due to topography are of the same order of magnitude as the wind deceleration upstream of a wind plant,” author Miguel Sanchez Gomez said. “As a result, measuring wind plant blockage in simple terrain requires having an accurate representation of the flow heterogeneities from topography to be able to differentiate them from one another.”

To simulate the flow around the wind plant, the team used the Weather and Research Forecasting model, inputting atmospheric conditions that matched the climatology around the Oklahoma wind plant. To quantify the influence of the turbines on the flow, the authors performed two nearly identical simulations—one with wind blockage, and another without.

For future studies, the authors plan to compare their simulations with actual measurements performed at the site.

Source: “Can lidars assess wind plant blockage in simple terrain? A WRF-LES study,” by Miguel Sanchez Gomez, Julie K. Lundquist, Jeffrey D. Mirocha, Robert S. Arthur, Domingo Muñoz-Esparza, and Rachel Robey, *Journal of Renewable and Sustainable Energy* (2022). The article can be accessed at https://doi.org/10.1063/5.0103668.

This paper is part of the Preparatory Work for the American Wake Experiment (AWAKEN) Collection, learn more here.