Center for Environmental & Applied Fluid Mechanics

"ON-AIR: Unraveling Wind Farm-Atmosphere Interactions"

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Abstract: Transitioning towards renewable energy sources necessitates a deep understanding of the intricate relationship between wind farms and the surrounding atmosphere, both onshore and offshore. In this seminar, I will explore some of the interdisciplinary challenges posed by these interactions.

The discussion begins with an exploration of the American WAKE ExperimeNt (AWAKEN), a groundbreaking international field campaign conducted in northern Oklahoma from 2022 to 2024. Since AWAKEN provides a substantial data set to validate numerical models of varying complexities, an international modeling benchmark has been organized to simulate wind farm wakes. I will present preliminary findings from the benchmark study, which provide invaluable insights into wind farm wakes and their impacts across diverse inflow conditions.

Shifting focus to offshore wind energy, wind farms are currently in development off the east coast of the United States, and are also expected to influence the local meteorology. I will introduce NOW-WAKES, a state-of-the-art offshore wind resource assessment dataset that enables detailed assessments of simulated impacts of offshore wind farm wakes. Leveraging these open-source data and an innovative machine-learning algorithm, I will present the simulated impacts of offshore wind farm wakes on wind speed, temperature, turbulence, and heat fluxes.

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