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**Investigating Blockage Effects in Large-scale Wind Farms Using Large Eddy Simulations** JESSICA STRICKLAND, RICHARD STEVENS, University of Twente, PHYSICS OF FLUIDS TEAM — Flow blockage can alter the performance of closely-spaced wind turbines as they obstruct incoming air flow. Unfortunately, this phenomenon is relatively under-researched and not yet incorporated into widely-used wind farm models. Some studies have shown that tightly-packed turbines can benefit from each other while others claim that blockage hinders the performance of large wind farms. Here, we use large eddy simulations (LES) to analyse an encompassing set of turbine array configurations in realistic neutral boundary layer conditions. We compare a stand-alone turbine, an infinite row of turbines, and a wind farm with eight rows, focusing primarily on how the blockage depends on the spanwise and streamwise turbine spacing. Our results show that different physical mechanisms play a role. The turbines appear to benefit from close, spanwise neighbours as the flow that is obstructed by one turbine is then diverted into the rotor area of another turbine, increasing its power production. In contrast, close streamwise turbines negatively impact the power output of upstream turbines as the flow is inclined to pass over the wind farm. In addition, we find that these blockage effects do not depend on the atmospheric turbulence intensity.

Jessica Strickland
University of Twente

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