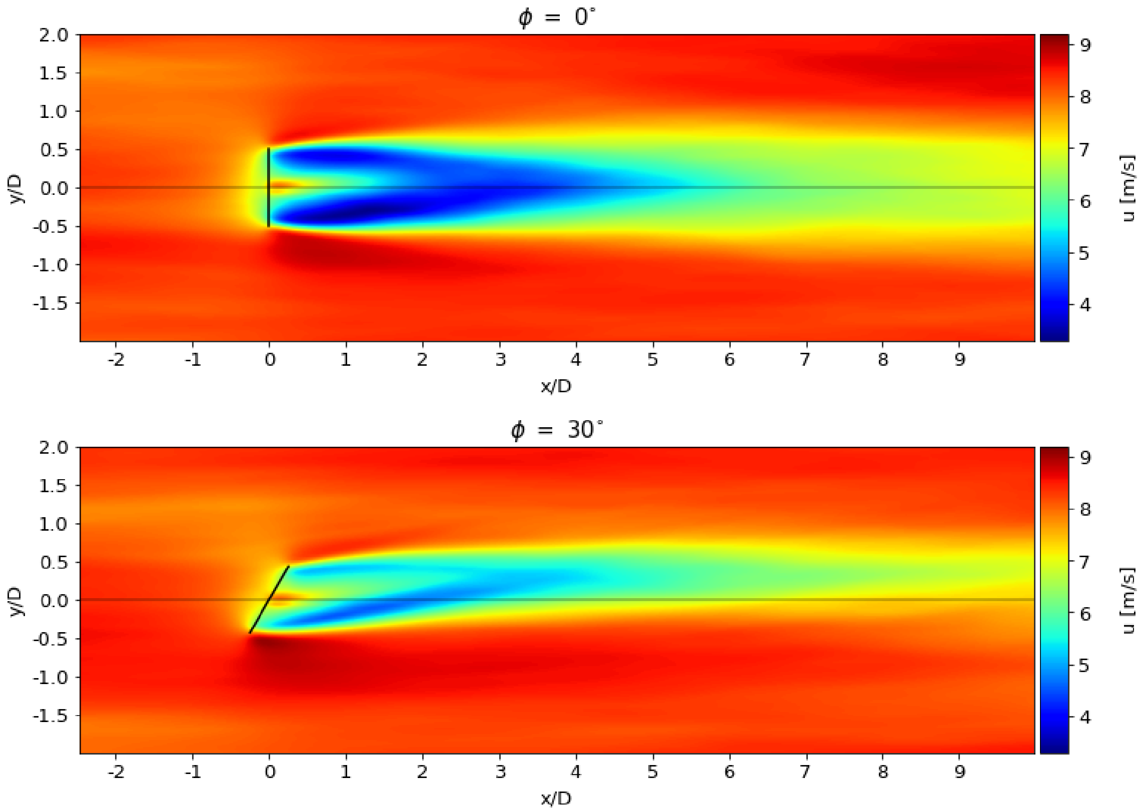
Master thesis

Extending a wind farm controller by considering the impact of atmospheric conditions



Caption: Visualization of active wake steering

Reducing the price of renewables is regarded as one of the most important elements in facilitating a global shift from traditional to renewable energy resources. In the field of wind energy, this encompasses the use of cheaper materials, the design of more efficient (often larger) turbines, but also to revise the way we think about wind farm control. Rather than controlling each individual turbine without considering its effects on surrounding turbines (greedy approach), turbines should be controlled according to an optimization strategy on wind farm level in order to reduce turbine wake effects.

One promising method that has recently received considerable attention in the literature, is active wake steering by intended yaw misalignment. In this approach, the upwind turbine is misaligned with respect to the inflow wind direction. This results in a displacement of the wind speed deficit, which consequently (partly) misses the downstream turbine. The power losses of the upstream turbine should be more than compensated by the power gains of the downstream turbine for this approach to be feasible. Next to numerical simulations and wind tunnel studies, a full-scale measurement campaign has recently demonstrated that this can indeed be achieved. Furthermore, continuous research has improved our understanding of the effect of ambient conditions on the applicability of this active wake steering method. In particular, atmospheric stability (roughly translates to ambient turbulence intensity) seems to have large implications for successful implementation of this method.

To apply this approach, a so-called controller needs to be implemented that automatically yaws the turbine depending on atmospheric inflow conditions, such as wind direction. Recently, a controller has been developed at ForWind that handles the large short-term variability in wind direction that naturally exists in the atmosphere. The evaluation of this 'robust' controller has indeed shown a power increase of a multi-turbine setup.

The goal of this project is to refine this new controller by including an adaptation sensitive to ambient conditions, in particular atmospheric stability. These developments will be based on data from a measurement campaign close to the Baltic Sea, and the newly developed controller will be evaluated by the use of numerical simulations.

Requirements: 1. Basic knowledge of numerical simulations 2. Programming skills are beneficial 3. Interest in problems related to renewable energy	**Begin:** **Duration:** **Contact:**	As soon as possible 6 months Luuk Sengers +49 (0) 441 798 5076 balthazar.sengers@uni-oldenburg.de Dr. Gerald Steinfeld +49 (0) 441 798 5073 gerald.steinfeld@uni-oldenburg.de