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Analysis of Anholt offshore wind farm SCADA measurements.

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SCADA measurements from the Danish Anholt offshore wind farm (ANH) for a period of 2½ years have been qualified. ANH covers 12 km × 22 km and is located between Djursland and the island Anholt in Kattegat, Denmark. This qualification encompasses identification of curtailment and idling periods, start/stop events and a power curve control for each wind turbine in the wind farm. Data also include wind speed measurements from a nearby WindCube lidar and simulations from the WRF model for the same period as the SCADA. An equivalent wind speed (wsi) is derived from the combined power and pitch signals for each wind turbine. Furthermore, the local wind direction is derived for a number of wake-free turbine groups. By combining the wsi and wind direction,the undisturbed wind speed and direction inflow conditions of the wind farm (U_{park} and WD_{park}) are estimated for all 360 degrees.
The preliminary analysis reveals a significant wind gradient along the North-South direction for the western row of the wind farm – for westerly inflow, together with a distinct wind speed reduction caused by coastal effects. Figure 1 shows how the coast influences the wind speed gradient along the western row of turbines. Furthermore, a minor wind speed reduction is identified for easterly inflow, caused by the island Anholt. The internal wake effects are small, due to the large "variable" spacing based on the arch-based layout compared to other wind farms. A comparison between simulated WRF and measured wind speeds shows good correlation. The power deficit along the rows of turbines demonstrates a significant difference between unstable and stable conditions.

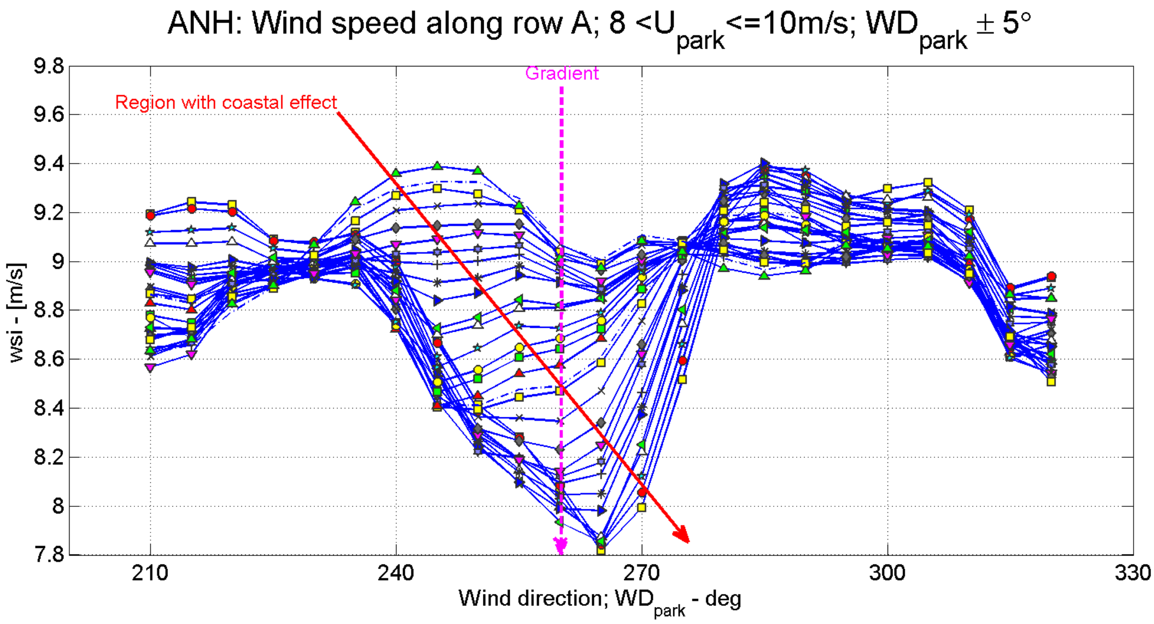

Figure 1: Wind speed variation along western row A as function of mean inflow angle and wind speed in the range 8 - 10 m/s. Each curve represents one of the 30 wind turbines in row A.

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