



Peculiar Events in Wind Farm Flows

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To estimate the power output of individual wind turbines within a wind farm usually wake models are applied. While single wake models are getting more and more accurate, satisfying multiple wake models are still lacking. This becomes evident when comparing calculated power output with measured ones. One reason for the relatively large deviations is the so-called meandering of wakes, making flow situations rather complicated and much different from the assumed steady wakes.

Combined measurements of LIDAR (light detection and ranging) system and conventional anemometers by RISOE National Laboratory have shown that it is possible to grasp the wake flow of a wind turbine by nacelle based measurements. ECN has investigated the measurements on its ECN Wind Turbine Test Site Wieringermeer (EWTW) for special wake flow events. EWTW consists of five in line installed 2.5 MW wind turbines. Using the nacelle anemometers and the transformation of those point measurements into wake flow information, we will show how large-scale wavelike wind direction changes and fronts pass through the wind farm. These singular events can cause very large, instantaneous yaw-misalignments, which consequently will provoke increased mechanical loads.

It is clear that these singular events cannot be grasped by linear superposition of single wake models, but will need more sophisticated models in the future.