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Wake modelling and measurements in Upwind

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This research is part of the EC funded UPWIND project which aims to investigate upscaling of wind turbines. Our workpackage is developing and evaluating wind turbine wake models for use in optimising wind farm layouts. Power losses due to wind turbine wakes are of the order of 10 to 20% of total power output in large wind farms. The focus of this research is wind speed and turbulence modelling for large wind farms/wind turbines to reduce power losses due to wakes and wake enhanced loading.

The first part of this work is to assess the state of the art in wake and flow modelling. For offshore wind farms, the focus so far has been cases at the Horns Rev wind farm which indicate wind farm models require modification to reduce under-prediction of wake losses while CFD models typically over-predict wake losses. Further investigation is underway to determine the causes of these discrepancies and new work is using data from the large offshore wind warm at Nysted.

For complex terrain, a set of three evaluations is underway. The first is a model comparison for a Gaussian Hill where CFD models and wind farm models are being compared for the case of one hill-top wind turbine. The next case where observations will be available is for the case of five turbines in flat terrain. Finally a complex terrain wind farm will be modelled and compared with observations.

The project therefore represents a set of unique evaluations of models with observa-

tions in different environments.