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Power losses from wakes in large offshore wind farms: Overview of the UPWIND Flow Workpackage

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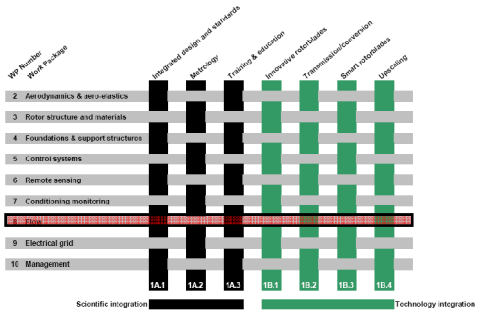
The flow workpackage in UpWind

UpWind is a European Union Sixth Framework Integrated Project consisting of more than 40 partners. The project looks towards the wind power of tomorrow, more precisely towards the design of very large wind turbines (8-10 MW), both onshore and offshore.

www.upwind.eu

The flow workpackage focuses on modelling and measurement of parameters relating to flow including wind speed, direction and turbulence particularly in large wind farms in complex terrain or offshore.



Wake data

Wind turbine wakes are volumes of reduced wind speed and increased turbulence generated downwind of wind turbines. While wind farm models adequately predict power losses due to wakes in small wind farms, wakes losses in large offshore wind farms are larger than predicted and wake losses in complex terrain have yet to be fully evaluated.

In this project we are using data from www.winddata.com and from specifically selected wind farms to evaluate wake model performance.

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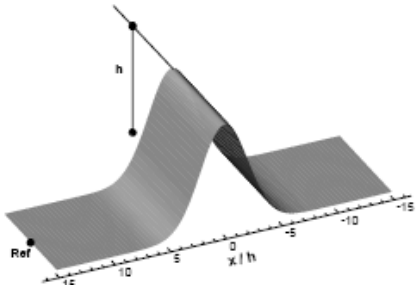
Wakes in complex terrain

Increasingly large wind farms are being constructed in complex terrain. These are often oriented along ridge lines with comparatively small wake losses but in the case of arrays, the behaviour of wakes is difficult to predict due to wake turning and narrowing.

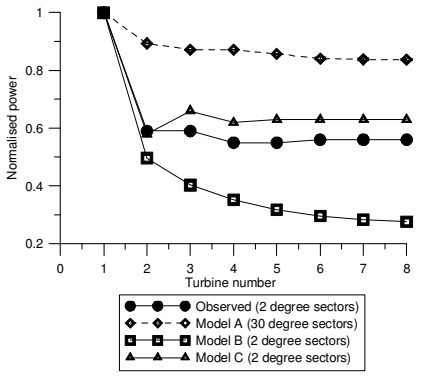
Our approach to building understanding of wake behaviour in complex terrain is:
- use of idealised topography and CFD modelling
- use of real wind farm data. Although most data are confidential we expect to reach agreement with one or more wind farm developers.



Wakes offshore

Wind farm models such as WAsP, Windfarmer and WAKEFARM have been shown to give reasonable predictions of wake losses for small offshore wind farms but in large arrays they tend to under-predict. Our research aims to find the physical causes for this behaviour in order that models can be adapted.

Simulations are being conducted on the Horns Rev data set (with thanks to DONG Energy). Preliminary indications are that wakes in narrow bins directly down rows are well simulated but overall wind farm models are under-predicting wake losses.



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