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THE BOLUND EXPERIMENT - A NEW DATASET OF LOCAL WIND CONDITIONS IN COMPLEX TERRAIN (abstract-ID: 357)

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The Bolund project is a combined measurement and modeling project related to wind conditions in complex terrain. An isolated steep hill, Bolund, at Roskilde Fjord will be equipped with nine measurement masts with conventional meteorological instruments and remote sensing Lidars at several positions for obtaining detailed information of mean wind, wind shear, turbulence intensities etc.
The data will be gathered in a database for validating advanced non-linear flow models using CFD tools. The paper will present details of the measurement campaign, with examples of the obtained data together with CFD results using the Risø/DTU flow solver EllipSys3D.

Numerous numerical codes for the calculation of flow and turbulence over complex terrain exist; from the fast-running linearized Jackson-Hunt type models to many sophisticated non-linear models: RANS, DES, LES, etc. Common for all these are that they use the famous Askervein experiment for verification. This experiment took place a quarter of a century ago with limited instruments and data acquisition capabilities. Furthermore, the Askervein hill was nearly Gaussian with not too steep slopes, which is not too challenging for the numerical codes.
The ambitious goal of the Bolund experiment is to measure the flow in great detail over a very steep terrain and provide for the community a comprehensive database of mean flow and turbulence statistics to be compared with any atmospheric flow model available.

The purpose of the Bolund project is to develop reliable methods for determining local wind conditions in complex terrains based on remote sensing techniques (Lidar) as well as conventional meteorological instruments in combination with advanced flow computations.
A detailed measurement campaign will be carried out on a characteristic hill at Roskilde Fjord, Bolund, which has several of the relevant properties that characterizes a complex terrain.
Time series of wind speeds and turbulence will be collected and analyzed from nine measurement masts equipped with sonics and cup anemometers at several heights together with data from Lidars at several positions. The measurement campaign will take place in late autumn 2007. These measurement data will form a basis for a detailed verification of advanced flow models based on the Navier-Stokes methodology.

The project includes four major tasks:
- Identification of characteristic flow conditions over complex terrain for reliable estimation of power production and wind turbine loads.
- Development of remote sensing techniques for measuring flow conditions in complex terrain including wind shear, turbulence intensities etc., at potential wind turbine positions.
- Application and further validation of advanced Computational Fluid Dynamics (CFD) models for flow over complex terrain.
- A publicly available comprehensive database consisting of experimental data will be built and used for evaluation of currently available flow models and methodologies for turbine siting in complex terrain regarding both wind resources and loads.

The present paper will present a detailed description of the measurement campaign including examples of the data available. Furthermore, results obtained with the incompressible CFD code EllipSys3D, which has been used for designing the measurement campaign including position of the masts, will be presented.