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Overview and background

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Published in:

EWEC 2009 Proceedings online

Publication date:

2009

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Bechmann, A., Berg, J., Christiansen, L. C., Courtney, M., Johansen, J., Ejsing Jørgensen, H., ... Sørensen, N. (2009). The Bolund experiment: Overview and background. In EWEC 2009 Proceedings online EWEC.

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ID: 191

TRACK: TECHNICAL TOPIC: Siting in complex terrains and forested areas

THE BOLUND EXPERIMENT: OVERVIEW AND BACKGROUND

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The Bolund experiment is a field campaign that provides a new dataset for validating numerical models of flow in complex terrain. It will be the basis for a unique blind comparison of flow models.

An increasing number of wind farms are being installed in complex terrain where wind resources are good, but the wind shear and turbulence can exceed the design basis. CFD is becoming a standard tool to quantify such wind conditions and determine the optimum positions of the wind turbines. However, these flow models have usually only been validated against wind tunnel experiments with simple terrain forms.

The Bolund experiment is a measuring campaign performed in 2007 and 2008. The Bolund hill, though relatively small (12m high), has a geometrical shape that characterize many complex sites e.g. a well-exposed, almost vertical upstream escarpment and Bolund is located with a well-defined inflow from the sea. During the campaign, velocity and high frequency turbulence data were collected simultaneously from 35 anemometers distributed on 10 masts, thereby generating a large database designed to validate CFD codes.

Today, many CFD codes, designed to simulate flow in complex terrain, are evaluated against simple hill experiments performed at laboratory scales in wind tunnels. Such evaluation is convenient since boundary conditions are clearly defined. Despite the benefits of wind tunnel experiments, full scale field experiments are necessary in order to validate the numerical models at the correct atmospheric scales and with realistic terrain forms.

Probably the best known field experiment is that over the Askervein Hill. This is a 116m high, isolated hill with moderate slopes where an extensive field campaign was performed in 1982 and 1983. During the Askervein campaign, velocity and turbulence data were collected, providing a unique dataset for validating terrain flow models. Many, even linear models, have shown good results in reproducing the upwind and hill-top flow but often fail on the leeside where separation occurs. In complex terrain, especially where separation can be expected, the models have not been validated sufficiently. With both upstream and downstream separation, the Bolund dataset allows just such a validation.

The present work describes the background of the experiment and gives a detailed description of the measuring campaign. However, no experimental results will be presented! One aim of the project is to assess the accuracy of models for flow in complex terrain. This will be achieved through a blind comparison where model predictions are compared with measured results. Modellers will be challenged to predict the wind flow over the Bolund terrain based on the conditions of the free wind and the orography. The blind test will start at EWEC 2009.