Technical University of Denmark

DTU

# Field validation of the RIX performance indicator for flow in complex terrain

**Mortensen, Niels Gylling; Tindal, Andrew; Landberg, Lars**

Link back to DTU Orbit

**DTU Library**
Technical Information Center of Denmark

Session: Wind resources and site characterisation 1 (BT1.3)
Track: Technical
**FIELD VALIDATION OF THE DELTA-RIX PERFORMANCE INDICATOR FOR FLOW IN COMPLEX TERRAIN (abstract-ID: 420)**
Niels G. Mortensen (Risø DTU, Wind Energy, Denmark)
Andrew Tindal, United Kingdom (1) Lars Landberg, (1)
(1) Garrad Hassan and Partners Ltd.

A comprehensive field validation of a ΔRIX-based correction scheme for wind climate and power production predictions, obtained with linearised models in complex terrain, is presented. The validation is based on meteorological and wind farm production data from about 10 wind farms, situated in rugged terrain which is outside the operational envelope of such models. The aim is to develop a simple and robust scheme which can be used to improve predictions obtained by employing linearised models in (too) complex terrain.

The site ruggedness index (RIX) has been used for more than 10 years to determine whether the topographical settings of a given meteorological station or wind turbine site in complex terrain are within the operational envelope of linearised flow models such as WAsP. The associated orographic performance indicator (ΔRIX) has been shown to provide the sign and approximate magnitude of the prediction errors for situations where one or both of the predictor and predicted sites are situated in terrain outside this operational envelope. The critical slope for application of linearised wind flow models has been confirmed to lie in the interval from 30 to about 40 per cent.

At the 2006 EWEC conference, a simple procedure based on ΔRIX was developed, in order to improve wind speed and power production predictions in terrain outside the operational envelope of the WAsP flow model. Results from a case study in northern Portugal, employing five meteorological stations with ruggedness indices between 10 and 33%, indicated an average improvement of WAsP power production predictions of 69%. Cross-predictions between pairs of sites with ΔRIX values larger than 5% were improved by more than 90% on average.

The ΔRIX-based correction procedure is empirical and must therefore be validated against in-situ wind climate and power production data. The present investigation will focus on: i) the applicability of the correction scheme under different climatological and topographical conditions, ii) determination of the site-specific fitting constant, iii) development of an improved procedure, e.g. including sector-specific corrections, iv) application of the results for improved wind farm power production predictions as well as wind resource mapping.

Comprehensive field validations of this ΔRIX-based correction scheme are presented based on meteorological and wind turbine data from about 10 wind farms in complex terrain. The wind farm sites are located in different climatological and topographical conditions, making an assessment of the universality of the empirical correction scheme and fitting constants possible. Analyses of the first four of these wind farm sites support the ΔRIX concept, but also indicate that the fitting constants may be site-specific. The remaining wind farm data will make a closer investigation of this issue possible. At one wind farm where power production data were available – and the scheme was applied with a standard setup – the prediction of the net annual energy production of the farm was improved by about 70%.

_____