Weather radars for wind energy applications

Trombe, Pierre-Julien; Pinson, Pierre; Vedel, Henrik; Barahona Garzón, Braulio; Madsen, Henrik

Publication date: 2013

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
WEATHER RADARS FOR WIND ENERGY APPLICATIONS

Pierre-Julien Trombe¹, Pierre Pinson¹, Henrik Vedel³, Braulio Barahona⁴, Henrik Madsen¹
¹ DTU Compute, Technical University of Denmark; ² DTU Electrical Engineering, Technical University of Denmark; ³ Danish Meteorological Institute; ⁴ DTU Wind Energy, Technical University of Denmark

INTRODUCTION

From 2009 to 2012, two weather radars were used to monitor weather conditions at the offshore site of Horns Rev, Denmark.

The goal of this experiment, called Radar@Sea, was to characterize meteorological phenomena associated with large wind fluctuations in order to improve the predictability and controllability of offshore wind power fluctuations in the very short-term, up to 2 hours ahead.

MOTIVATIONS

Both empirical observations and meteorological analysis reveal that large wind fluctuations tend to occur simultaneously with precipitation at Horns Rev [1-2].

IDEA & OBJECTIVE

Weather radars are the ideal tools for detecting and tracking precipitation at high spatio-temporal resolutions. Our objective is to extract the relevant information from weather radar observations and integrate that information into a wind power prediction system [3].

APPLICATIONS

Classification of offshore wind regimes Design of regime-switching controls for offshore wind farms Weather radar data assimilation into meteorological models

DMI is developing a NWP nowcasting system based on the DMI-HIRLAM model running with a 3 km horizontal resolution. Radar data and satellite cloud cover will be included in the data assimilation. The forecast will be done hourly, and the output fields will have a time resolution of 10 minutes.

The speed and direction of advection of precipitation, as well as its maximum reflectivity are important for characterizing wind variability (see [4]). Integrating regime-switching forecasts into controls can help reducing wind power fluctuations when needed (see [5]).

DMI is developing a NWP nowcasting system based on the DMI-HIRLAM model running with a 3 km horizontal resolution. Radar data and satellite cloud cover will be included in the data assimilation. The forecast will be done hourly, and the output fields will have a time resolution of 10 minutes.

DID YOU KNOW? Weather radars can also be used for detecting migrating birds and monitoring wave height at offshore wind farms.

CONCLUSIONS

Even though further research is still needed for integrating weather radar observations into forecasting systems through data assimilation or tracking convective precipitation cells for instance, weather radars are called to play an important role for wind energy applications in the future.

ACKNOWLEDGEMENTS

This work was supported by the Danish Public Service Obligation (PSO) fund project ‘Radar@Sea’ (under contract PD0009-1-0226) which is gratefully acknowledged. We are grateful to the Danish Meteorological Institute (DMI) for sharing the data from the Horns radar. We also thank Vattenfall and DONG Energy respectively, for providing wind power data from the Horns Rev 1 wind farm and the images generated by the LAMH.

TO READ ON THE TOPIC


contact: pmtr@dtu.dk