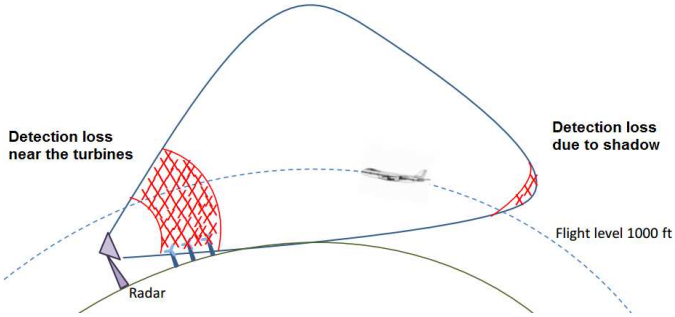
Radar Distortion due to Wind Turbines

Master thesis Electrical Engineering or Physics

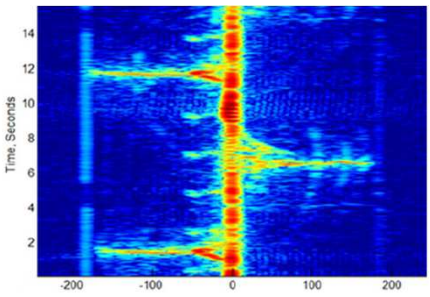
Introduction

Radar systems are used for applications such as weather prediction, coastal security and air traffic control. Wind turbines can interfere with such radars. This research focusses on primary radars for air traffic control. This radar emits a signal that reflects on airplanes and is then received again by the radar. Wind turbines can distort air traffic control radars roughly through two mechanisms. Firstly by decreasing transmission between radar and target (shadow). And secondly by reflecting the radar signals of the radar (backscatter). The backscatter is a big problem as the rotating wind turbine blades reflect the radar signal with Doppler shifts, which currently cannot be discriminated from flying airplanes.



Problem definition

TNO uses a model (PERSEUS) to predict the distortion of primary radars due to wind turbines. This model includes both effects of transmission loss and reflection. For this thesis we intent to validate the backscatter part of the model. The backscatter of wind turbines has been by the TUDelft (using the PARSAX radar). The measured PARSAX data has to be modelled and compared with the PERSEUS model results. The outcome of the model is a single scan detection probability of an airplane, so a smart comparison with the raw measured data is needed.



← measured backscatter data

Goal

The main goal is to correlate measured wind turbine backscatter data with the simulation model. You therefore need to model the PARSAX radar and the measured wind turbines for the simulation. The simulation results then need to be compared to the measured data. The PERSEUS model preferably needs to be validated for several wind turbine types, environments and weather conditions. Possibly more measurements should be done. It is possible to suggest improvements to the model based on the measured data.

Contact

A. Brettschneider MSc.
Electronic Defence, TNO
Tel. +31 (0)88 86 64433

Dr. Oleg A. Krasnov
Microwave Sensing, Signals and Systems (MS3),
Faculty EWI, TU Delft
Tel. +31 (0)15 27 86256

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