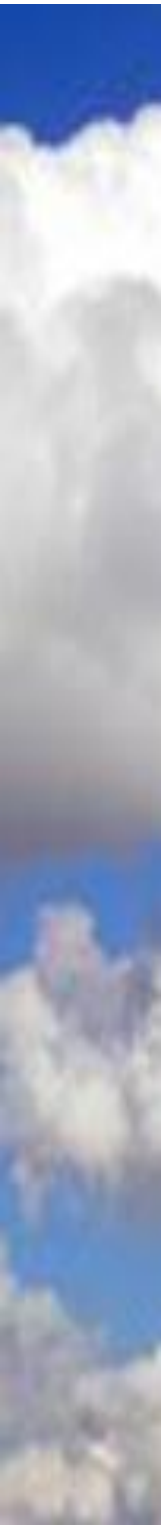
MSc Thesis in Remote Sensing of the Atmosphere

Wind turbines characterization and mitigation for polarimetric weather radar



Being reflected by surrounded raindrops, the microwave signal from ground-based weather radars provide maps of rainfall rate. Compared to the granular measurement obtained by rain gauges, the radar covers a much larger spatial area which is paramount for many applications in meteorology, flood, and climate change monitoring.
However, such radar images can suffer from unwanted, non-atmospheric echoes called 'clutter' that hampers the quality of the retrieved rainfall information. An example of clutter is wind turbines echoes.
The requirement for clean and renewable energy is expanding over the past several decades. Among these energy sources, wind power is the leading source of new power generating capacity. Apart from the wind turbine quantity boost, the average wind turbine sizes have been continuously increasing at the same time. However , it has been gradually known that echoes from wind turbines are severe interference for weather radar systems, deteriorating the performance significantly. Hence it is imperative to find effective solutions to characterize and mitigate wind turbine echoes in weather radar.

An extensive data set has been acquired for this purpose by a mobile Doppler polarimetric X-band radar in Switzerland during a 1-month dedicated wind farm signatures measurement campaign. The radar provided Doppler and polarimetric measurements as well as complex spectra from HH and VV channels in various meteorological conditions. An initial analysis of the dataset has already been performed using the MeteoSwiss-developed open source Python-based processing environment Pyrad. At Delft University of Technology, several clutter mitigation techniques, which use Doppler polarimetric data, are available. In this master project, the student will characterize the wind turbines radar measurements. The next step is to enhance existing techniques to detect and remove the wind turbine echoes in weather radar data.

The supervision is organized at the TU Delft Department of Geoscience and Remote Sensing (The Netherlands) and co-supervised by MeteoSwiss (Switzerland). For the interested student, this topic provides a great experience in radar meteorology. This master thesis work can lead to a publication.

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