

A statistical method for estimation of wind farm influence on radar data and its mitigation

*Zlatko R Vukovic¹, Norman Donaldson¹

1. Environment and Climate Change Canada

The Canadian Weather Radar Network is assessing the impact of wind turbines on radar data. Where it was possible to collect radar data for periods before and after a wind farm installation, the proposed statistical methodology was used as an objective tool to estimate the level of contamination of radar data due to wind farm interference. The methodology was useful to estimate the efficiency of mitigation techniques such as interpolating data surrounding the wind turbines.

Four elements underlie the suggested methodology, which is defined as a physical concept and mathematical procedure. The first element is the formulation of variables that have normal distributions, which are relative disturbances of radar reflectivity (Z) and radial velocity (V). The second element is the use of the Mann Whitney U test as a statistical tool for comparison of the distribution shapes and acceptance/rejection of hypotheses that two distributions are likely derived from the same population. The third element is processing radar data on a grid of neighboring radar bins (9 or 12), not just the bins above the turbines and, therefore, it was possible to examine a spatial domain of wind turbine influence. The last element is decomposition of processed data in regards to certain known factors that influence homogeneity of the data. The goal was to analyze the impact of wind turbines as a dominant factor of possible influence on contamination of Z or V radar data.

To demonstrate this methodology, it was applied to real operational radar data. The conclusions for specific wind farms differed depending on the numbers and size of turbines, as well as the relative radar location. The purpose here is to outline the methodology rather than present specific case results.

Keywords: wind farm, mitigation, weather radar, clutter, data processing, wind turbine