Weather Radar with Abundant Wind Farming – Impacts on Data Quality and Mitigation by Doppler Dual-Polarization

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In recent years, large amount of wind turbines have been installed in Europe, contributing to the growth in the renewable energy capacity. The wind farms are visible at far distances due to their preferred siting and due to their increased size. The rotors reach significant heights above the radar horizon. Due to the abundance of these moving targets, interfering echoes are unavoidable in the observations of weather radar networks.

We have evaluated the impact of wind farming on weather radar data quality in Galicia, North-West Spain. Persistent patterns of echo in data from a regional Doppler dual-polarization weather radar are associated with the known locations of wind farms. Estimates are obtained for the strengths of the interfering echo which define the lower limits of truthful values of reflectivity of the observed precipitation fields. Significance of these lower limits is quantified through conversion into estimates of accumulated rain fall.

Capability of the Doppler dual-polarization weather radar to mitigate wind turbine interferences is demonstrated through analysis of operational data spanning seasons. The mitigation is evident when general purpose quality control tools are applied as an integral step in the radar signal processing, and when the observations are compared to data obtained in co-incidence at proximate radar using legacy processing. The echoes from rotating wind turbines are intrinsically distinct from those of precipitation, which implies they can be identified as non-precipitating echo by using state-of-the-art methodology of dual-polarization. The impact of these mitigation steps is evaluated in the quality of the observations.