

13.8 A SIMULATION-BASED AND EXPERIMENTAL APPROACH TO INVESTIGATE THE IMPACT OF SKYSCRAPERS AND WIND TURBINE FARMS ON WEATHER RADAR DATA

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As a result of the increasing needs for renewable energy and smart-multiple floor tall buildings in crowded metropolitans, the number of wind turbines and skyscrapers is rapidly increasing within the last decade. In this study, the impact of wind turbine farms and skyscrapers built after the installation of Istanbul weather radar are investigated through simulation-based analyses and actual radar outputs. It is seen that the single polarization Doppler radar in Istanbul can filter the clutter echoes caused by the targets such as skyscrapers and mountains; however, it may not completely remove the clutter from wind turbines due to their rotating blades. Partial Beam Blockage (PBB) due to wind turbine- or skyscraper-based beam shielding is the other error source. PBB diagrams, beam blockage fractions and Radar Quality Index (RQI) are derived by using 30 m resolution digital elevation database and modified open source wradlib code. Since the digital elevation databases do not include skyscrapers and wind turbines, their effects are not seen in PBB and RQI fields. This study shows that radar quantitative precipitation estimates (QPE) are also adversely affected by these error sources, resulting in under or over-estimation of precipitation. Simulation results and experimental analyses verify the adverse effects of the wind turbine- or skyscraper. Additionally, it is stated that super refraction can occur due to the low-level inversion; hence the radar beam may bend more even if it is not seen in theoretical PBB diagrams where the standard atmospheric refraction applies. This study presents visual examples including radar products, Google maps and PBB diagrams to support the statements.
