Wind Science-Based Radar Measurements

By: John Schroeder

The wind plays several important roles in our lives. Some of these roles are beneficial (e.g. energy generation), while others are detrimental (e.g. windstorm damage). However, regardless of whether we are harvesting wind energy or protecting our infrastructure, the details of the wind matter to engineering design.

Atmospheric scientists have long been studying the atmosphere; making a wealth of measurements and simulations that encompass a wide range of different phenomena. We've benefited greatly from their success. For example, weather radars offer a powerful tool to examine the structure and location of precipitation and the strength of a weather system. However, this same technology has not historically helped inform the engineering community.

Engineers need details. They need answers to how the structure of the wind (e.g. the average size of a gust) varies from one weather event to another, especially at elevations close to the ground where the wind interacts with what they are designing. Historically, these details have been acquired using instrumented towers, but having the right kind of instrumentation on the right tower in the right place at the right time to properly sample a windstorm is difficult. And even when successful, it still only provides a point measurement. Hence, there are still a lot of unknowns.

A mobile TTUKa research radar deployed at a wind plant to take detailed measurements of the wind flowing through the plant.

At the National Wind Institute, we're approaching the problem from a different perspective. What started with using mobile research radars to map the complex flows in wind farms has now grown to target windstorms as well. We're using our unique research radar systems to make atmospheric measurements at very high resolutions with the objective of not only helping to advance understanding of the atmosphere, but also to inform engineering design. We're trying to revolutionize how an engineer understands the winds in the lower atmosphere.

Of course, the end goal is to inform engineering design, which will provide safer homes and buildings and help minimize the impact of windstorms. At the same time, similar details about the lower level wind can help build smarter wind turbines and wind plants to maximize the energy extraction and lower the cost of energy to society.

About the Author

John Schroeder is a Professor of Atmospheric Science and the Senior Director of the National Wind Institute at Texas Tech University. Dr. Schroeder has developed a nationally recognized research program focused on the measurement and characterization of low-level wind fields, created a unique suite of atmospheric observing technologies, pioneered the usage of radar to measure wind farm complex flows, and executed numerous atmospheric field campaigns.