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Message:

- The purpose of the experiment in details. How is the test performed?

A Wind Profiling Radar (WPR) is a weather observing device that uses electromagnetic signals to remotely detect wind speed and direction at various elevations above the ground.

WPRs transmit pulses of electromagnetic radiation vertically and in at least two slightly off-vertical (~75 degree elevation) directions to resolve the three-dimensional vector wind. A small amount of the energy transmitted in each direction is reflected or backscattered to the radar. The backscatter returns are Doppler shifted by the motion of the scattering media. The return signals are sampled in the receiver at discrete intervals called range gates.

Profilers receive backscatter returns from atmospheric features (turbulence, clouds, precipitation) and non-atmospheric features (insects, birds, trees, airplanes, radio frequency interference). The challenge in signal processing is to focus on the atmospheric returns. To do this, profilers integrate thousands of consecutive samples to boost the signal-to-noise ratio of the atmospheric returns, a process known as coherent integration.

A set of coherent integrations is processed to produce a single Doppler velocity spectrum, and a set of spectra are averaged together to improve the detectability of the spectral peak. The strongest peak in the spectrum is analyzed and assumed to be the peak resulting from atmospheric backscatter. The spectral peak is analyzed to produce a set of Doppler spectral moments, the first three of which correspond to the signal power, radial velocity, and spectral width. This is repeated for each range gate and for each of the transmitted beam directions.

A wind profile is constructed by geometrically transforming the radial velocities into the meteorological coordinate system. A single wind profile is produced over an observing period of 30 to 90 seconds. All of the wind profiles measured within a specified averaging period (15 min to 60 min) are averaged together using a consensus routine. 915 MHz systems are frequently referred to as "boundary layer profilers" and have a typical lowest range gate near 100m, with a maximum detectable signal that varies with atmospheric conditions (higher in a moist atmosphere) but that typically ranges from 1.5 to 4 km above ground level. Typically two vertical sampling modes are interlaced in time, a 60 m high resolution mode and a coarser resolution 100m mode.

The University of Illinois wind profiling radar is mounted on a trailer for mobile operations. The radar will be deployed from its home base by University Personnel to target meteorological phenomena in a region of interest. For example, a thunderstorm event that is targeted by a research project may focus on a storm in Arkansas. We would deploy the system from our University in Urbana, Illinois the days before the storm, and set it up for operations for a 3-24 hour period. Trained university personnel would operate the system, fully attended, to ensure nominal operations during the data collection period. The system would then be undeployed and return to the base of operations. The flexibility to deploy the system to targeted events within 2000 km of Urbana, Illinois is critical to the success of the experiment.

- Who will terminate the system if interference occurs?

The radar wind profiler will be continually monitored by trained University staff on site during its operation, and they will terminate the system if interference occurs. Quick look images are continually displayed on the system to monitor the Doppler spectra for interference. The system will be redeployed to another site

if interference occurs, since the interference would contaminate the measurements. Figure 5 on page 16 of this report by the World Meteorological Organization illustrates how interference can be easily monitored in the returned spectra ([https://www.wmo.int/pages/prog/www/OSY/Meetings/ET-SBRSO\\_ET-RSO-2011/DocPlan/5.4\(1\)\\_Profiler\\_DQ\\_Issues.pdf](https://www.wmo.int/pages/prog/www/OSY/Meetings/ET-SBRSO_ET-RSO-2011/DocPlan/5.4(1)_Profiler_DQ_Issues.pdf))

- City/State, Latitude/Longitude.

The radar wind profiler's home base will be the University of Illinois at Urbana, IL (40.093131N, -88.22893W). The mobile system will be deployed to weather events in the eastern 2/3 of the United States depending on weather conditions to observe phenomena such as thunderstorms, hurricanes, or other significant weather events being studied.