

Short Course Description

Basics of Polarimetric Doppler Radar and Weather Observations

A comprehensive, up-to-date review of Polarimetric Doppler Radar Technology

This course reviews the principles of polarimetric-Doppler weather radar and application to the observation of weather and the quantitative measurement of meteorological parameters. Fair weather observations with radar are also presented. Extensive examples of weather phenomena are shown together with radar signatures. The potential of agile-beam phased-array technology is discussed.

How you will benefit:

Understand the theory, design, operation, and applications of polarimetric Doppler weather radar. Focus on meteorological phenomena, their radar signatures, and quantitative measurement of weather parameters.

Who should attend:

Meteorologists, weather forecasters, physicists, and engineers. Other professionals who need to understand applications of Doppler weather radar. Although there is no specific prerequisite for this course, participants should have an understanding of elementary physics and mathematics.

The Principles of Polarimetric-Doppler Weather Radar

Electromagnetic waves; polarization; propagation through a spherically stratified atmosphere; anomalous propagation; pulsed-Doppler radar; polarimetric radar; transmitted waveform; signals received from point and distributed scatterers; attenuation and its dependence on polarization; back scatter and attenuation cross sections and its dependence on polarization; hydrometeor size distributions; the radar equation; representations of echoes from moving and stationary scatterers; radar limitations

What you will learn:

Weather Signals and Doppler Spectra

Signal statistics; echo coherency; signal to noise ratio for weather echoes; the weather radar equation; angular and range weighting functions; receiver filter loss; resolution volume; the reflectivity factor; correlation of echoes in range and time.

Discrete Fourier transform and window functions; Doppler spectra of signals from precipitation and clear weather; relation between wind, reflectivity, and the Doppler spectrum; examples of Doppler spectra associated with various weather phenomena.

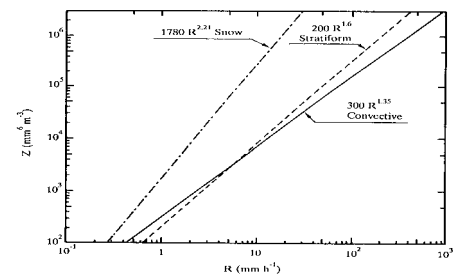
Weather Signal Processing

Spectral moments; estimation of reflectivity using range and time averaging; autocovariance and spectral processing to estimate mean Doppler velocity and spectrum width; signal processing for coherent polarimetric radar; performance of the estimators; real time display techniques; examples of fields of reflectivity factors, radial velocity, turbulence, differential reflectivity, differential phase, and cross-correlation between horizontally and vertically polarized signals



Considerations in the Observation of Weather

Spectrum width; wind shear and turbulence; antenna sidelobes; echo obscuration; ground and sea clutter; techniques to extend unambiguous range and velocity; the effective width of a scanning beam; thunderstorm structure; wind estimation with two Doppler radars; severe local storms, mesoscale convective systems, and hurricanes.



Precipitation Measurements

Single parameter techniques (e.g., using reflectivity factor Z or specific differential phase K_{DP}) to estimate rain rate R; relations between Z, R, and liquid water content; accuracy of rain measurements; two-parameter techniques to estimate rainfall; polarimetric variables from precipitation and other scatterers; polarimetric measurements at various wavelengths; improvements in data quality using the polarimetric variables; mitigation of attenuation with polarimetric variables; classification of precipitation type using the polarimetric variables; improvements of rain measurements with polarimetric radar.



Observation of Winds, Storms, Fair Weather and related Phenomena

Visual depiction of storm phenomena (e.g., tornadoes, microbursts) and their radar signatures, wind field estimation using single Doppler radar; weather hazards to aviation.

Bragg scatter from irregularities in temperature and humidity; observations of wind, buoyancy waves (i.e., undular bores, solitary waves, etc.), and turbulence in clear air; temperature and wind profiling with specialized Doppler radars. Non meteorological scatterers and spectral densities of polarimetric variables, examples of displays and products, automatic detection of hazardous weather. Agile-beam phased-array radar.

