ECE/METR 6613: Weather Radar Polarimetry

Prereq.: Graduate status

Class: Mon.-Wed.-Fri. 2:00pm-2:50am, NWC5930,

Office hours: Wed. 3:00pm-4:00pm & Fri. 3:00pm-5:00pm, NWC4620,

Instructor: Guifu Zhang (guzhang1@ou.edu), (405)325-3507

Text: G. Zhang: Lecture notes – Weather Radar Polarimetry with Matlab®, 2015

References:

R. J. Doviak and D. S. Zrnic: *Doppler Radar and Weather Observations*, 2006, 1993, 1984

A. Ishimaru: *Wave Propagation and Scattering in Random Media*, 1997, 1978

V. N. Bringi and V. Chandrasekar: *Polarimetric Doppler Weather Radar: Principle and applications*, 2001

Course description

This course provides fundamentals and principles for polarimetric radar remote sensing through understanding wave scattering and propagation in geophysical media filled with hydrometers and other objects. Physical, statistical and electromagnetic properties of the hydrometeors are characterized, and typical polarimetric radar signatures for a variety of weather events are described. The relations between radar observables and physical state parameters will be established. Advanced remote sensing techniques (e.g., polarimetric phased array radar) and retrieval methods for physical parameters will be introduced. Applications of polarimetric radar measurements in hydrometer classification, particle size distribution retrievals, microphysical parameterization, weather quantification and forecast will be illustrated.

Course Content

Chapter 1: History of weather radar development

Chapter 2: Characterization of hydrometeors

Statistical and electromagnetic properties of hydrometeors (rain, snow, hail…)

Chapter 3: Wave scattering and absorption by a single particle

Scattering amplitude/cross section for spherical and non-spherical particles: understanding and calculations based on Rayleigh scattering approximation, Mie theory, and T-matrix methods

Chapter 4: Scattering and propagation in media filled with distributed particles

Attenuation/differential attention, phase/differential phase, depolarization, transmission matrix, covariance matrix, spatial/time/frequency correlation of scattered waves from moving scatterers

Chapter 5: Polarimetry radar measurements

Polarization radar variables and their estimates, accuracy of radar measurements, polarization signatures of hydrometeors

Chapter 6: Applications in weather quantification and forecast

Fuzzy logic method for hydrometeor classification, constrained methods for drop size distribution retrieval and accurate precipitation estimation, attenuation corrections, microphysical parameterization, data assimilation

Chapter 7: Advanced weather radar technology

Phased array radar technology, polarimetric phased array radar research and development, weather radar interferometry, multi-frequency/site radar techniques.

Grading

Homeworks	30%
Projects	40%
Final	30%