Under the Hood

How Signal Processing in the WSR-88D Provides the Best Quality Data

Short Course Organizers

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SUNDAY, August 27, 2023

Time	Topic	Description
8:00 AM	OPENING, INTRODUCTIONS, PROGRAM INFO	Get acquainted and provide course overview
8:30 AM	Part 1 – Radar Basics	WSR-88D Introduction and acquiring samples for producing base data estimates
9:30 AM	COFFEE BREAK	
10:00 AM	Part 2a – Base Data, the Spectral Moments	Power and reflectivity estimation, noise management, reflectivity calibration
11:00 AM	Part 2b – Base Data, the Doppler Spectral Moments	Velocity and spectrum width estimates, bias and variance, RV ambiguity mitigation
12:00 PM	LUNCH	
1:00 PM	Part 3a – Polarimetric Variables, ZDR	The Polarimetric WSR-88D upgrade, estimating differential reflectivity, ZDR calibration
1:45 PM	BREAK	
2:00 PM	Part 3b – Polarimetric Variables, differential phase and correlation coefficient	Determining initial phase, phase wrapping, transmit phase effects, importance of noise compensation for correlation coefficient
3:00 PM	Part 4 – Data Quality and Future of NEXRAD	Clutter mitigation, RFI, wind turbine clutter, data quality verification, evolution of meteorological radar
3:45 PM	COURSE END	

PART 1 - RADAR SYSTEM BASICS

PART 2 - BASE DATA, THE SPECTRAL MOMENTS

PART 3 - BASE DATA, THE POLARIMETRIC VARIABLES

PART 4 - MITIGATING ARTIFACTS AND ASSURING DATA QUALITY

Part 1 – Radar System Basics

Introduction to the WSR-88D

History, basic specifications, key elements

Documentation, NTR, SS, ICDs

Acquiring the Samples

Radar equations, noise, coherency, phase noise, methods of noise estimation and management, dwell time, number of samples, dynamic range, windowing, sensitivity, point vs. distributed target detection

The RVP 900 architecture and sample acquisition

Part 2 – Base Data, The Spectral Moments

Power and Reflectivity Estimates

Signal to noise ratio, SNR and # of samples effects on variance, sources of bias (calibration, atmospheric losses, clutter), range of estimates, verification methods and examples

Doppler Estimates

Velocity and Spectrum Width

Bias, variance, range of estimates, number of samples and SNR effects on variance, hybrid spectrum width estimator, verification methods and examples

R-V ambiguity mitigation, split cuts and overlaid echoes, multiple PRF scans (MPDA), SZ phase coding, staggered PRT

Part 3 – Base Data, The Polarimetric Variables

ZDR, range of estimates, calibration, variance requirements, ZDR calibration monitoring

Differential Phase and Specific Differential Phase, initial PHI determination and phase wrapping, transmit phase issue

Correlation Coefficient, importance of proper noise compensation

Part 4 – Mitigating Artifacts and Assuring Data Quality

Ground Clutter (normally and anomalously propagated), RFI, wind turbine clutter

Bias (Moments and Polarimetric Variables)

Filters - Legacy filters, GMAP, two pulse canceller, CLEAN-AP, interference filter

Filter Control - bypass maps, filter selections, CMD, WET

Verification methods and examples

Continued Data Quality Program at the ROC, NSSL, and NCAR

Future NEXRAD