Weather Radar Polarimetry

• Zhang Text - Introduction
• Relevant Texts on Meteorological Radar
• Sources
• Content
• Focus on Chapter 5
  – Estimators
  – Clutter Identification and Filtering
• For Further Investigation - Chapter 7
• Discussion
“There are several texts describing the theory and application of weather radars including Doppler radars, but relatively few that focus on polarimetry.”

Based on Dr. Zhang’s course at OU offered by the School of Meteorology and the School of Electrical and Computer Engineering.

“In Weather Radar Polarimetry Dr. Zhang takes a unique approach to teaching weather echo processing, polarimetric theory, and the application of theory to the interpretation of polarimetric weather radar observations.”
Preface

• “...another set of measurements we can use to better study weather: polarimetric radar data (PRD).”

• “Although the technology of radar polarimetry has matured and PRD are available nationally and worldwide, radar polarimetry is still in its initial stages for operational use.”

• “...important to know principles of radar polarimetry and PRD estimation and improvement, as well as information content, and error characterization.”

• “...need for a textbook that meteorology students, scholars, and scientists can use to obtain this knowledge.”

• Supporting data and tools available
Texts on Meteorological Radar Theory

1959

1973

1993

2001

2004

2015
Weather Radar Polarimetry
Guifu Zhang

August 1, 2016 by CRC Press
Reference - 304 Pages - 37 Color & 101 B/W Illustrations
ISBN 9781439869581 - CAT# K13193

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Chapter 5 - Radar Measurements and Improvement of Data Quality

- **Multilag Correlation Estimators**
  - Reduce effects of noise component
  - Two-Lag Estimator
  - Three Lag Estimator

- **Clutter Detection**
  - Power Ratio Discriminant - “cousin” of CMD’s CPA
  - Dual Polarization Discriminants
  - Dual Scan Discriminant
  - Dual-pol Dual-Scan Discriminants (DPDS)
  - Simple Bayesian Classifier (SBC)

- Let’s look at Figure 11
FIGURE 5.11  SBC-DP clutter maps (a, d, g) compared with the ground truth (b, e, h) for the three testing data. $P_R$ as a function of CSR (dB) is shown in (c, f, i) for the three testing data. The blue line represents the performance of the SBC-DP in detecting ground clutter in the presence of both w and w0, whereas the red line represents the performance in the presence of only w0.  

FIGURE 5.11 (Continued)  SBC-DP clutter maps (a, d, g) compared with the ground truth (b, e, h) for the three testing data. $P_R$ as a function of CSR (dB) is shown in (c, f, i) for the three testing data. The blue line represents the performance of the SBC-DP in detecting ground clutter in the presence of both w and w0, whereas the red line represents the performance in the presence of only w0.  

(Continued)
Detecting and Removing Clutter is Critical for Polarimetric Variable Quality

Friedrich, Germann and Tabary, 2009

Ellis and Hubbert, 2011
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For Further Study


Discussion

• Dr. Zhang presents some concepts potentially useful to the NEXRAD program
  – Multilag estimators for other than CC
  – Clutter identification
  – Clutter ID performance evaluation

• Further investigation could be beneficial
  – DPDS, BGMAP - CMD, GMAP, CLEAN-AP
  – Look at Chapter 7 - Retrievals

• Future TAC presentation?

• Coordinate with NEXRAD Data Quality Team

• Radar Operations Center Engineering Change Proposal Team (ECP 0708) may want to investigate.