

Dual Polarization Radar Training

Facilitator Workshop

NOAA/NWS Warning Decision Training Branch

Jami Boettcher

Mark Sessing



WDTB Dual-Pol Training Team & You

- Seth & "my guys"



- WDTB is at your service



Dual-Polarization Radar Upgrade and Training Schedule

2010 Q4	2011 Q1	2011 Q2	2011 Q3	2011 Q4	2012 Q1	2012 Q2	2012 Q3	2012 Q4	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	
		Beta Test 1 st Radars upgraded													
		Deployment 10-14 days downtime each radar													
<h2>WDTB's Dual-Pol Outreach Courses</h2>															
Webinars: "Dual-Pol Warmup" & "Storm of the Month"															
<h3>WDTB's Dual-Pol Radar Operations Course</h3>															
<h3>Dual-Pol Radar Principles & System Operations Course</h3>															
End Goal: Develop Knowledge															
					<h3>WDTB's Dual-Pol Lessons Learned</h3>										
					End Goal: Develop Expertise										

What is the Story on These Webinars?

- Dual-Pol Warmup Training

- Target audience: beginners
- Duration: 1 to 1.5 hours
- 3rd Wed each month
- Recorded session (apologies to Steve)?



- Dual-Pol Storm of the Month

- Target audience: familiar with Dual-Pol base products
- Duration: 30 minutes
- Last Wed each month
- Recorded sessions posted to NWS Learn Center



Dual-Polarization Radar Training for NWS

- Two courses



Warning Decision Training Branch

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Dual-Polarization Radar Training

[| Training Options](#) | [DP Radar Principles](#) | [DP Operations](#) | [DP Tools](#) |

Training Options

To support the WSR-88D Dual-Polarization upgrade deployment, the Warning Decision Training Branch has prepared operational training designed for NWS and Tri-agency users, as well as [NWS core partners](#). Deployment is expected to begin in September of 2011. The [Deployment Schedule](#) will likely change over time.

There are two courses available to NWS users, each with their own development plans. We recommend that NWS users begin their course work **3-4 month prior** to the installation of dual-polarization technology at their local WSR-88D site. The completion goal for the NWS Dual-Polarization Radar Operations Course is one month after the dual-polarization installation is complete. These courses are:

Development Plan	Completion Requirements	Suggested Audience
Dual-Polarization Radar Principles and System Operations	<ul style="list-style-type: none">• 2 RDA lessons• 3 RPG lessons	SOOs, radar focal points, & others by local office determinations
Dual-Polarization Radar Operations Course	<ul style="list-style-type: none">• Overview• 6 product lessons• 6 application lessons• 2 (of 4 total) WES exercises	All NWS Decision Makers

Dual-Polarization Course Development Plans

⊕ WDTB Dual-pol Radar
Operations Course

Due Date:NA

Overall Status: INCOMPLETE Completed Date: NA

1. “WSR-88D Dual-Pol Radar Operations Course”
 - Overview, product and applications modules
 - Recommended for all NWS decision makers

⊕ WDTB Dual-Pol Radar
Principles and System Operations

Due Date:NA

Overall Status: INCOMPLETE Completed Date: NA

2. “WSR-88D Dual-Pol Radar Principles and System Operations”
 - RDA and RPG modules
 - Recommended for all SOOs and radar focal points
 - Local office determination for remainder of staff

Dual-Polarization Radar Principles & System Operations Course

- 5 Online Modules
 - RDA
 - RPG
 - Data artifacts
 - Algorithm strengths and limitations
- SOOs, RFPs, others designated

National Weather Service
Warning Decision Training Branch

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Dual-Polarization Radar Training

Training Options

WDTB eLearning

Jami Boettcher
Instructor

Outline Thumbnails Notes Search

- 19. 8 Hour Check Notification
- 20. Attenuation of Z
- 21. Differential Attenuation of ZDR
- 22. ZDR and De-Polarization
- 23. ZDR and De-Polarization
- 24. What's in the Beam?
- 25. Uniform Beam Filling
- 26. Non-Uniform Beam Filling
- 27. Non-Uniform Beam Filling and CC
- 28. Non-Uniform Beam Filling and CC
- 29. Non-Uniform Beam Filling and CC
- 30. Non-Uniform Beam Filling and CC
- 31. Summary of ϕ_{DP} & Propagation Media
- 32. Non-Uniform Beam Filling and CC
- 33. Wet Radomes Happen!
- 34. ZDR and the Trees
- 35. RDA Lesson 2 Quiz
- 36. Questions?

Non-Uniform Beam Filling and CC

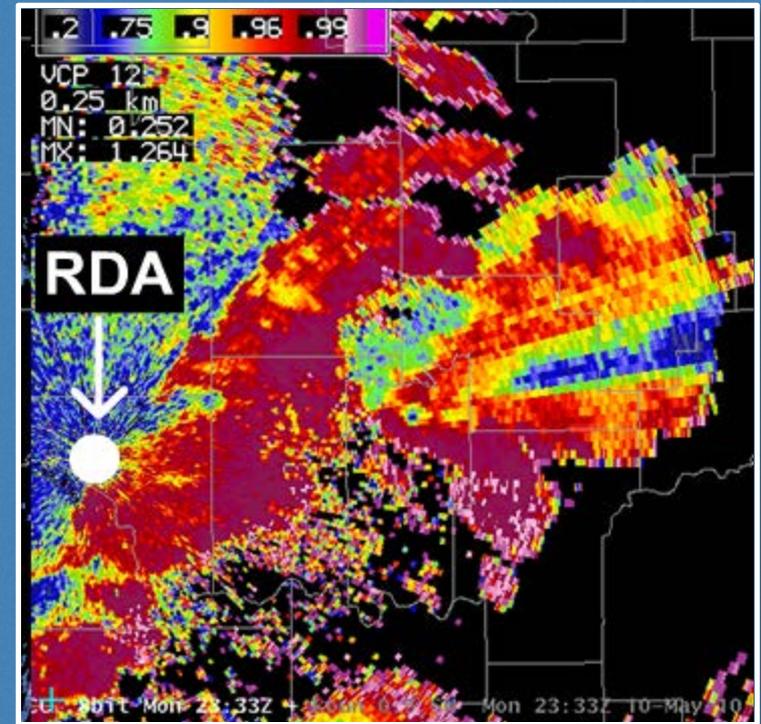
- Impacts on Dual-Pol derived products at RPG

The diagram illustrates the processing of radar data. It starts with a raw radar scan (left) showing a non-uniform beam filling artifact. This data is processed into CC (Common Core) data (middle), which is then processed into HCA (Hybrid Core Algorithm) data (right). Finally, the HCA data is processed into DPR (Dual-Pol Radar Product) data (bottom right). White ovals highlight the non-uniform beam filling artifact in the raw data and its impact on the CC, HCA, and DPR products.

Dual-Pol Radar Principles

RDA Modules

- Lesson 1: Generating Dual-Pol variables
- Lesson 2: Sensitivity, Calibration, Attenuation, Non-uniform Beam Filling
- 20-25 mins
- SOOs & radar focal points, then others as appropriate



Dual-Polarization Radar Principles & System Operations Course

- 5 Online Modules
 - RDA
 - RPG
 - Data artifacts
 - Algorithm strengths and limitations
- SOOs, RFPs, others designated



Dual Polarization Radar Operations Course

- 13 Online Modules
 - Overview
 - Products
 - Applications
- 2 of 4 WES Exercises
- Completion Reports
- Certificates of Completion
- All NWS decision makers

National Weather Service
Warning Decision Training Branch

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Dual-Polarization Radar Training

Windows Internet Explorer
noaa.gov/courses/du/pol/Applications/WW/layer.html

Winter Weather Applications (02:59 / 25:06) ATTACHMENTS

WDTB eLearning

Paul Schlatter
WDTB Meteorologist
Instructor

Outline Thumbnails Notes Search

1. Dual-Pol Applications: Winter Weather Nowc
2. Course Outline
3. Objective
4. Prior to Using Dual-pol Products for Winter V
5. Winter Weather Nowcasting Methodology
6. Dual-Pol Radar Winter Weather Decision Tre
7. Dual-pol Base Data Product Characteristics c
8. Steps to Detect Melting Layer Using PCR All-
9. Detecting a Melting Layer Gives You a Robu
10. Assume You Find a Well-defined Melting La
11. Sleet Potential
12. Rain/Freezing Rain Potential
13. Caveat: Melting Hydrometeors Detected, bu
14. Winter Weather Radar Analysis Decision Tri
15. Dual-pol Base Data Product Characteristics
16. Dual-pol Base Data Product Characteristics
17. What about "other" Snow?
18. Limitations of Dual-pol Winter Weather Sign
19. Dual-pol Heavy Rain Detection Training Aid:
20. Winter Weather Quiz
21. Questions?

Winter Weather Nowcasting Methodology

- Look for Melting Layer
- No really, look for Melting layer!
- If none exists
 - All Snow
 - Drizzle

County/Boundaries

SLIDE 5 OF 21 PLAYING 00:41 / 00:52 NOTES

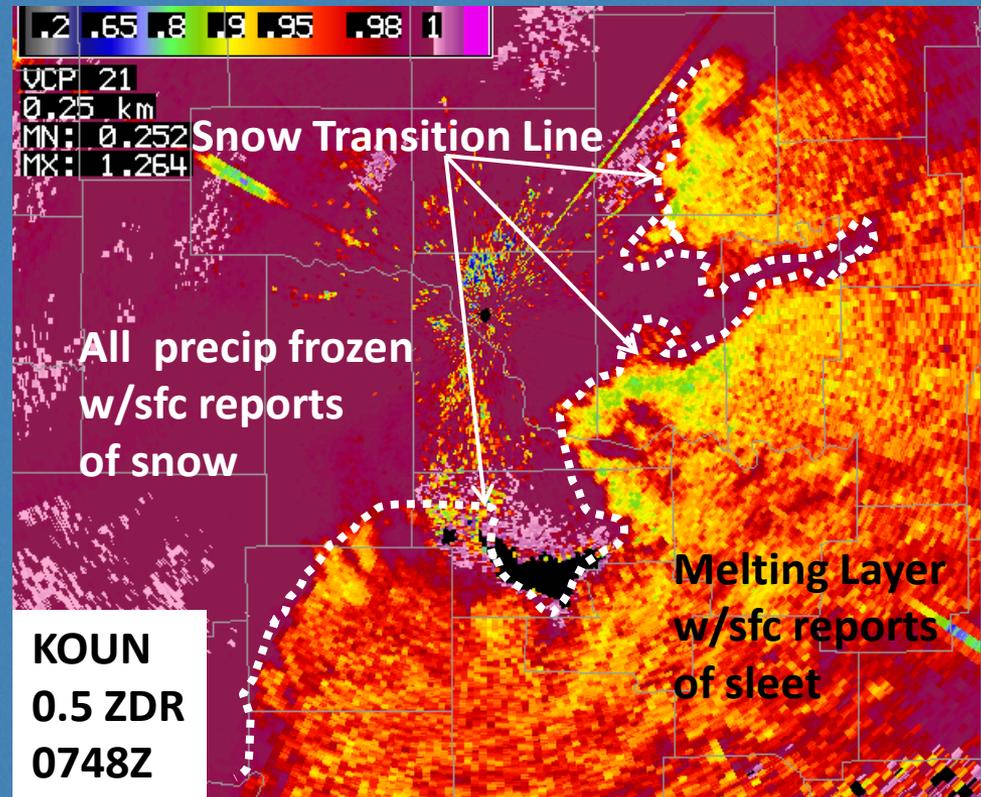
Dual-Pol Ops Course: Products

- 6 Product Modules

- CC
- ZDR
- KDP
- Hydrometeor Classification
- Melting Layer
- Dual-pol QPE

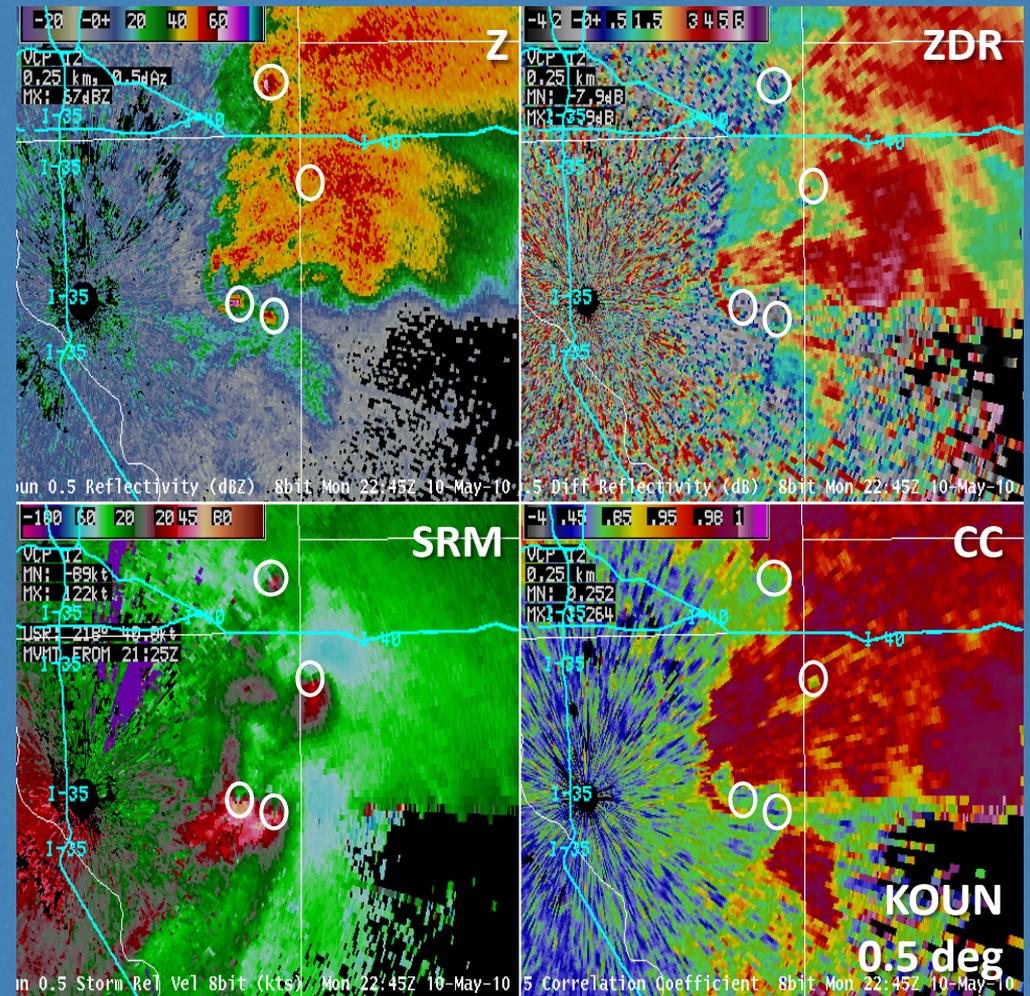
- <30 mins each

- All NWS WSR-88D Users



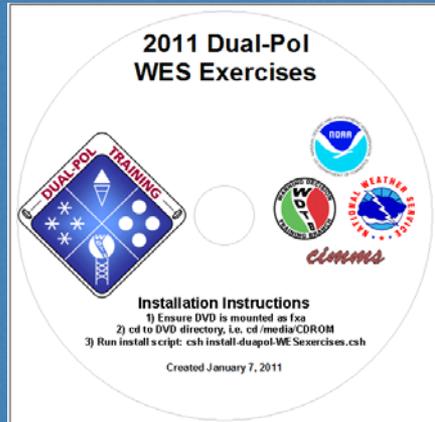
Dual-Pol Ops Course: Applications

- 6 Applications Modules
 - Winter Weather
 - Hail Detection
 - ZDR Columns
 - Heavy Rain Detection
 - Tornadic Debris
 - Non-precip detection
- 20-25 mins
- All NWS WSR-88D Users



WES Exercises

- Case review mode with recorded answer keys
 - Winter Weather
 - Tornadoes/Hail
 - Bow Echo
 - Flash Flooding
- Any 2 of the 4 for course completion



Dual-Polarization Radar Operations Course Part 1 WES Exercises

Dual-Pol WES Exercises Overview

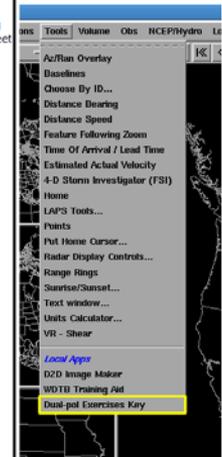
This document contains 4 jobsheets that step you through a dual-pol radar analysis in case review mode on the WES. All events are from central Oklahoma from the WSR-88D Dual-Pol KOUN. Each jobsheet in this document is specific to a particular high impact event and you don't have to work through them in any particular order. Including viewing the self-contained answer keys, these will take a total of roughly 7 hours to work through but completion times will vary from person to person. The jobsheets are:

1. Winter Weather: ~90 min analysis time + 26 min answer keys
2. Heavy Rain: ~60 min analysis time + 22 min answer keys
3. Tornadoes and Hail: ~100 min analysis time + 60 min answer keys
4. Bow Echo: ~40 min analysis time + 20 min answer keys

Answer Keys

Answer keys are provided on a question by question basis, and are loaded directly off the WES! They each consist of a narrated video screen capture, demonstrating how Paul Schlatter from WDTB would have answered each question on his WES. It's up to you *when* you want to view the answer key for each question, either immediately after you fill out the answer or at the end of the jobsheet. In any case, please load the answer key launch page right off the tools menu (right graphic below). A firefox window will open containing links to each of the jobsheet answer keys (left graphic below). Make sure you have a way to hear the narration associated with each video screen capture answer key.

Dual-Pol WES Exercises Answer Key			
This page has the links to view camtasia presentations of the answers to each of the questions that make up the dual-pol operations courses WES exercises. Each link below will launch an external window containing the answer(s) to the jobsheet and questions listed.			
Winter Weather Jobsheet (12/24/09, 2/26/10, 3/20/10)	Heavy Rain Jobsheet (June 14, 2010)	Tornado/Hail Jobsheet (May 10, 2010)	Bow Echo Jobsheet (May 19, 2010)
Question 1 Key	Question 1 Key	Question 1 Key	Question 1 Key
Question 2 Key	Question 2 Key	Question 2 Key	Question 2 Key
Question 3 Key	Question 3 Key	Question 3 Key	Questions 3-4 Key
Question 4 Key	Question 4 Key	Question 4 Key	Question 5 Key
Questions 5-6 Key	Question 5 Key	Question 5 Key	Question 6 Key
Question 7 Key	Questions 6-7 Key	Question 6 Key	Question 7 Key
Question 8 Key	Question 8 Key	Question 7 Key	Question 8 Key
Question 9 Key	Question 9 Key	Questions 8-9 Key	Question 9 Key
Question 10 Key	Question 10 Key	Question 10 Key	
Questions 11-13 Key	Question 11 Key	Question 11 Key	
Question 14 Key	Question 12 Key	Question 12 Key	
Question 15 Key		Question 13 Key	
Question 16 Key		Question 14 Key	
Questions 17-18 Key		Question 15 Key	
		Question 16 Key	
		Question 17 Key	
		Question 18 Key	
		Question 19 Key	
		Question 20 Key	
		Question 21 Key	
		Question 22 Key	
		Question 23 Key	
		Question 24 Key	



Dual Polarization Radar Operations Course

- 13 Online Modules
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Blended Learning Tools & Growing Expertise

WDTB Dual Pol Training

1. Products

- **Zdr** - Differential Reflectivity
- **CC** - Correlation Coefficient
- **Kdp** - Specific Differential Phase
- **HC** - Hydrometeor Classification Algorithm
- **ML** - Melting Layer
- **Precip** (DPR, PRE, OHA, DAA, STA, DUA, DO)

2. Applications

- Winter Weather

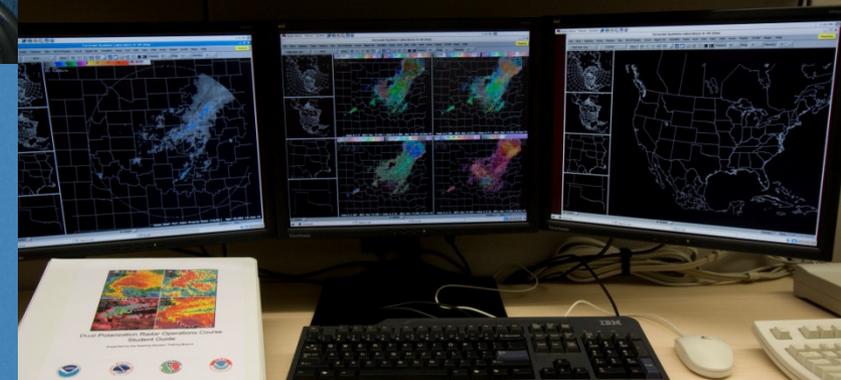
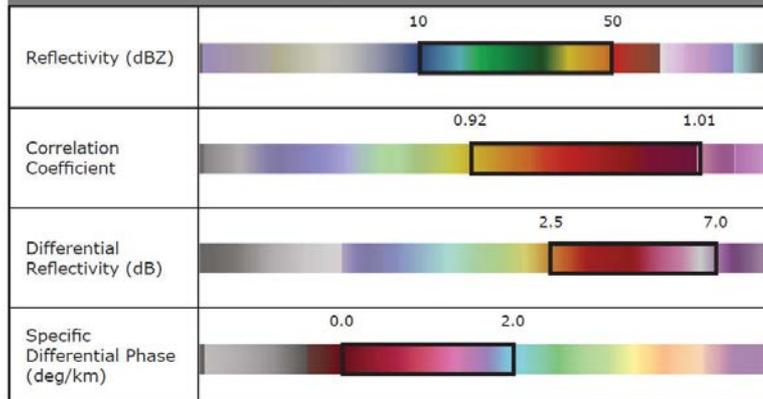


NWSchat &



Big Drops

Big drops describe areas typically located near thunderstorms that contain a small number of very large, liquid drops. Very light rain rates define the area of big drops. Big Drop regions are characterized by values of low to midrange Reflectivity and medium-to-high Correlation Coefficient. Differential Reflectivity will vary, but be weighted towards the largest drops in the volume. Specific Differential Phase should be relatively low since the number of drops is few.



dualpol_list@wdtb.noaa.gov

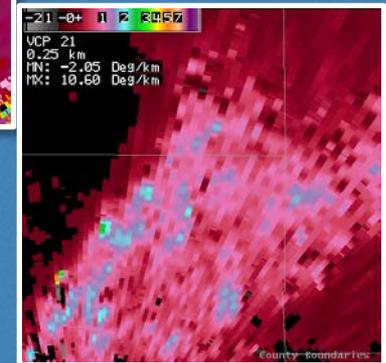
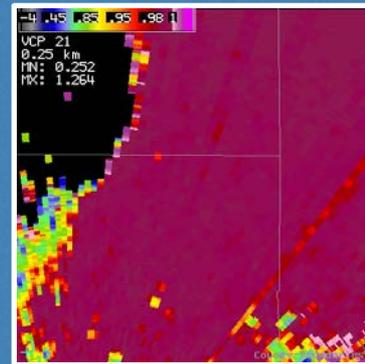
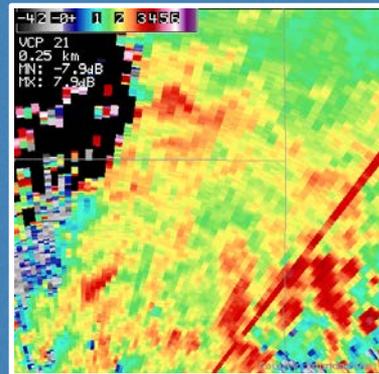
Dual-Pol Operations Course Expectations

- Start course 3-6 months prior to upgrade or back-up office's upgrade
- All staff finished by 1 month following upgrade of primary radar
- Course available through end of deployment (2013)
 - Content into Fall 2012 DLOC & Spring 2013 AWOC



Research to Operations

- Where We Stand
 - “Do No Harm” to legacy product suite
 - Base data (ZDR, CC, KDP) adds confidence wrt conceptual model, identifying hail, heavy rain, non-met echo...

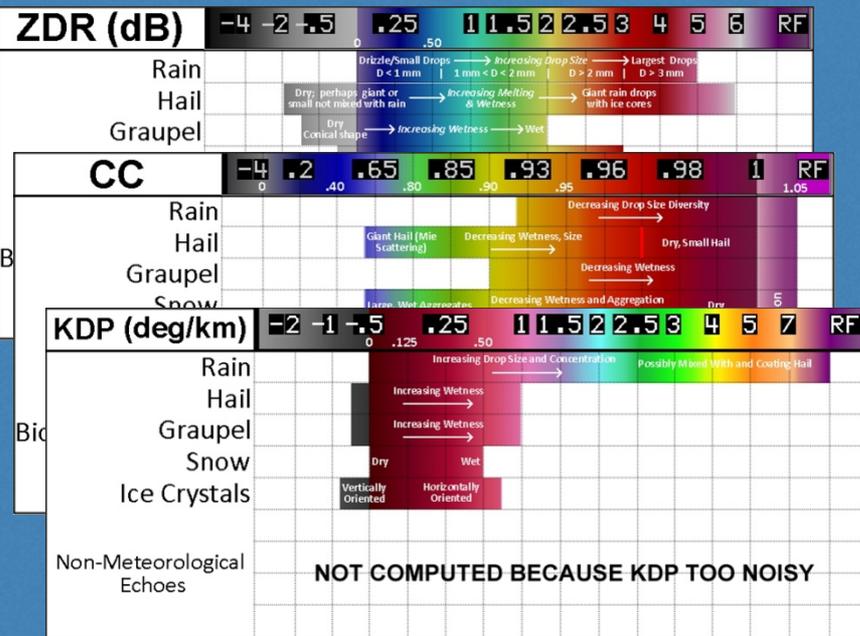


- Hardware has shown stability

Research to Operations



- Dual-Pol RPG Algorithms (MLDA, HCA, & QPE) in their infancy
 - Design also based on expected values from research
 - Research conducted mostly in OK
 - Work remains to “tune” algorithms

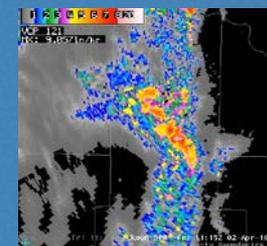
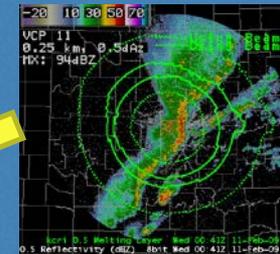
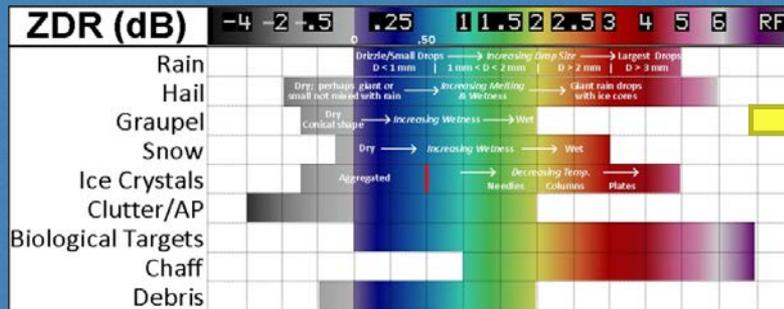


Generate Products

Research to Operations



- QPE expectations & ZDR
 - Rain rates computed from Z, ZDR & KDP
 - Also dependent on HCA & MLDA
 - ZDR used by QPE where **HCA** says light/mod R (**RA**), big drops (**BD**), or heavy rain (**HR**) with minimal blockage
- Many ways to adjust QPE



FAQs Regarding Course Facilitation

QUESTION	TIMELINE
How do I assign the course learning plan (formerly known as development plan) to my staff?	2 months prior to deployment
How do I set completion milestones?	2 months prior to deployment
How do I monitor completions using available reporting?	Weekly
By what date does everyone in my office need to complete the course?	January 31, 2012 or one month following deployment, whichever comes last
How and when will my staff receive a completion certificate?	E-mailed to facilitator from WDTB upon completion

Loading/Executing the WES Exercises

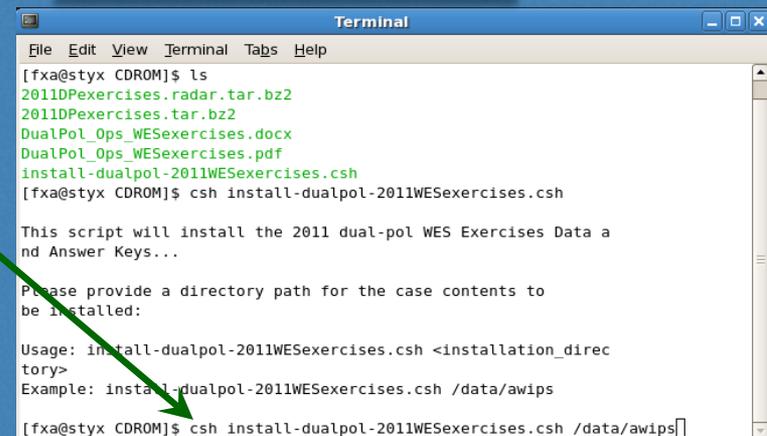
1. Insert the 2011 Dual-Pol WES exercises disc into your WES machine. The disc dated January 7, 2011 that you should already have and the disc dated September 15, 2011 contain the same materials.
2. Ensure you are user fxa in your terminal window.
3. Get into the CDROM directory.
4. Install the exercises by typing `csh install-dualpol-2011WESexercises.csh /data/awips`.



```
Terminal
File Edit View Terminal Tabs Help
[fxa@styx ~]$
```



```
Terminal
File Edit View Terminal Tabs Help
[fxa@styx ~]$ cd /media/CDROM
```



```
Terminal
File Edit View Terminal Tabs Help
[fxa@styx CDROM]$ ls
2011DPexercises.radar.tar.bz2
2011DPexercises.tar.bz2
DualPol_Ops_WESexercises.docx
DualPol_Ops_WESexercises.pdf
install-dualpol-2011WESexercises.csh
[fxa@styx CDROM]$ csh install-dualpol-2011WESexercises.csh
This script will install the 2011 dual-pol WES Exercises Data and Answer Keys...
Please provide a directory path for the case contents to be installed:
Usage: install-dualpol-2011WESexercises.csh <installation_directory>
Example: install-dualpol-2011WESexercises.csh /data/awips
[fxa@styx CDROM]$ csh install-dualpol-2011WESexercises.csh /data/awips
```

Loading/Executing the WES Exercises (cont'd)

- To take the exercises, simply type `start_awips` and load the appropriate case from the `/data/awips/2011DPExercises` directory.
- To view the PDF, double-click the CD icon on your desktop and open the PDF. You can also print each exercise by going to <http://www.wdtb.noaa.gov/courses/dualpol/index.html#exercises>.



Thank You!



- Resources:

Email: dualpol_list@wdtb.noaa.gov

NWSchat: "WDTBchat" chat room

"ROCchat" chat room (NWS only)

Website: <http://www.wdtb.noaa.gov/courses/dualpol>

- ROC's Dual-Pol site:

<http://www.roc.noaa.gov/WSR88D/dualpol/>

- Course Facilitation Support:

Mark Sessing

405-325-1091

mark.l.sessing@noaa.gov

