



# Update on Two-Dimensional Velocity Dealiasing Algorithm

Dave Zittel  
ROC Applications Branch  
Presentation to  
NEXRAD Technical Advisory Committee

# Outline

- Review of 2-Dimensional Velocity Dealiasing Algorithm
- Changes to the 2 dimensional velocity dealiasing algorithm (VDEAL) since the November 2009 Technical Advisory Committee meeting
- Test results
  - NSSL evaluation & example
  - ROC evaluation & examples
- Field test summer & fall 2011

# 2-Dimensional Velocity Dealiasing Algorithm (VDEAL)

- Uses least-squares approach to dealias velocity discontinuities simultaneously on a full velocity field
- Develops its own wind profile– doesn't use RPG's Environmental Wind Table
- Develops a coarse (sub-sampled) global solution and then resolves discontinuities in smaller regions
- Assigns more weight to velocity differences near  $\pm 2V_N$

# Changes to VDEAL Since Fall '09

- First and last radials are connected azimuthally – improves background wind field estimate
- Velocity differences with low spectrum width values are given greater weight than those with high spectrum width values
- Velocity values from side-lobe contamination are temporarily removed during dealiasing
- Regions connected by a narrow bridge of data are dealiased separately

# Comparison of NSSL and ROC Analyses

## NSSL

- All elevation angles
- Examined both 1 deg and ½ deg resolution velocity products
- Evaluated 1 clear-air; 5 precipitation events
  - VCPs 12, 31 & 212
  - Hurricane, squall line, storms, & frontal boundaries
  - ~920 1 deg velocity products
  - ~200 ½ deg velocity products

## ROC

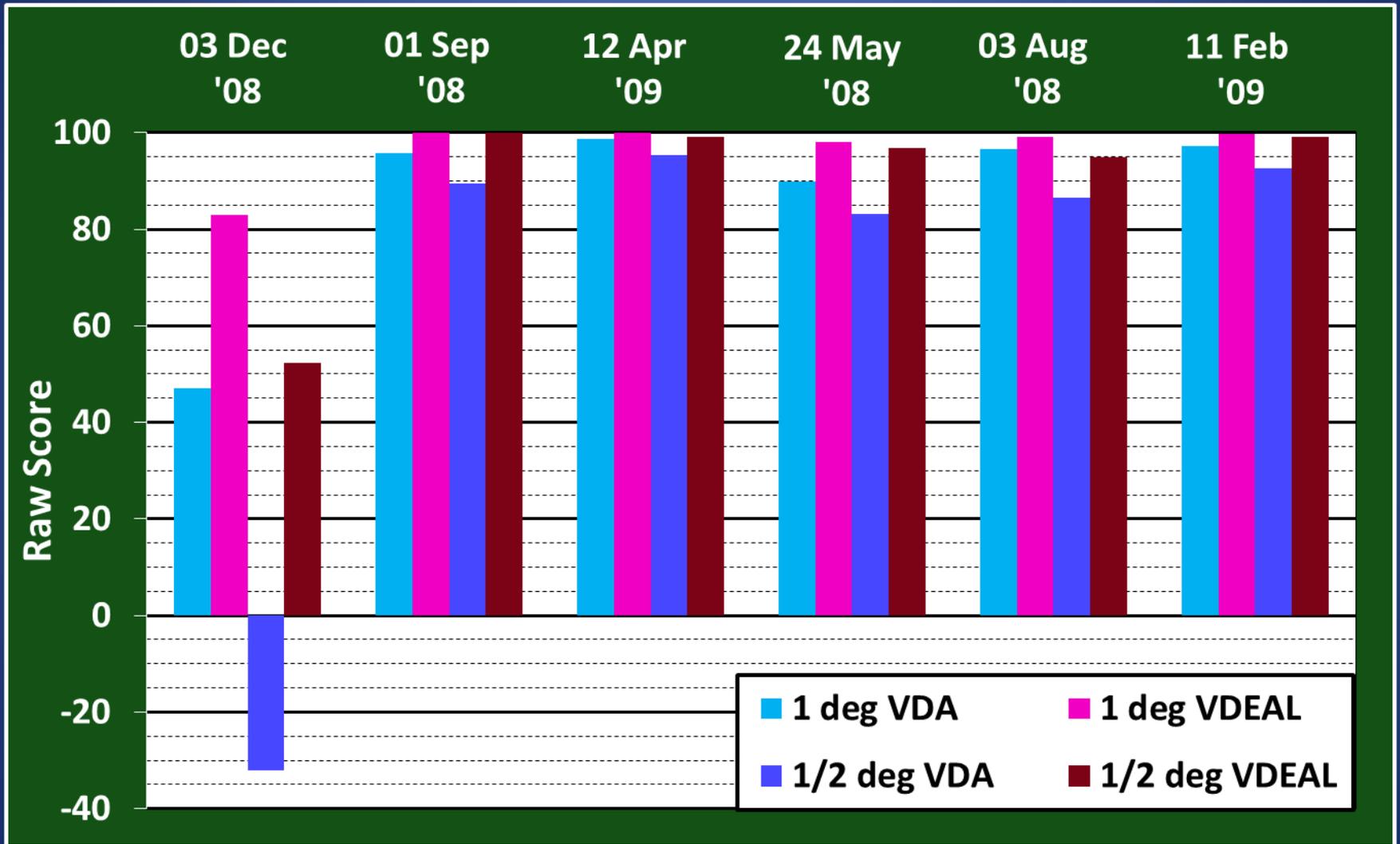
- 0.5 deg elevation angle
- Examined only 1 deg resolution velocity products
- Evaluated 15 precipitation events
  - VCPs 11, 12, 21, & 212
  - Hurricanes, squall lines, & tornadic storms
  - 520 1 deg velocity products

# Scoring Methodology Used by NSSL and ROC

Each velocity product image starts with a score of 100 from which points are subtracted as follows:

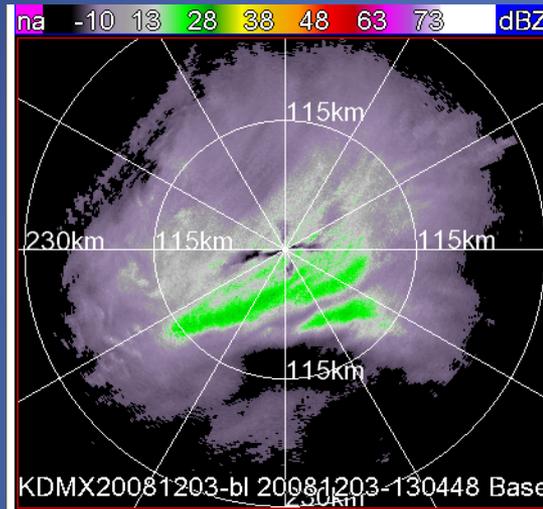
<u>Description of Error</u>	<u>Penalty</u>
Single gate or 2 adjacent gates	-1
Small radial spike (<3 km in length)	-2
Very small patch	-2 to -3
Small patch	-4 to -8
Large patch	-8 to -12
Swath of ~20	-12 to -16
Swath of ~40	-26 to -30
Swath of ~60	-32 to -38
Swath of ~90 or larger	-40 to -50

# NSSL Results

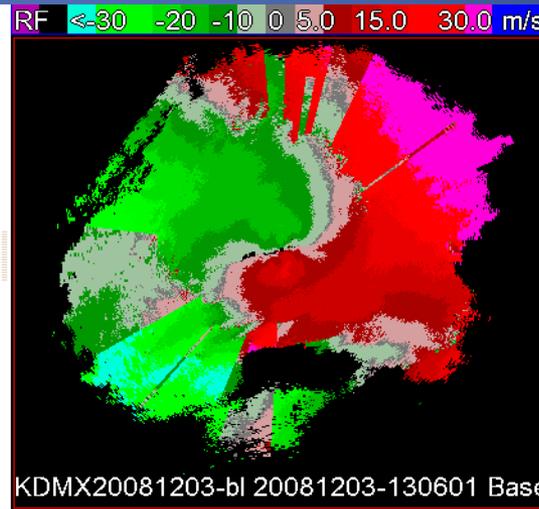


# KDMX, 3 Dec '08, 13:02Z, VCP 31, 1.5° Elv Frontal Boundary South of Radar

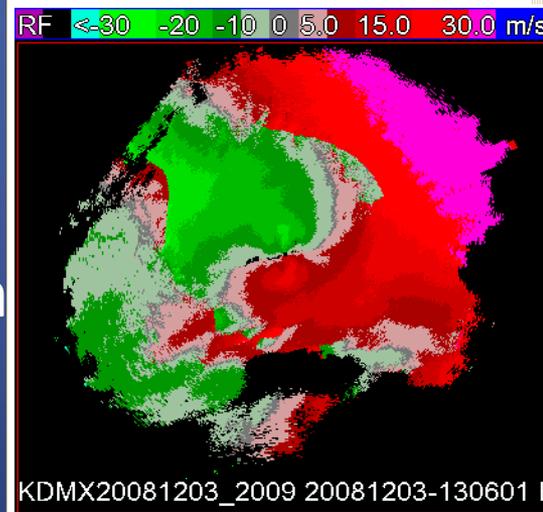
Reflectivity  
image



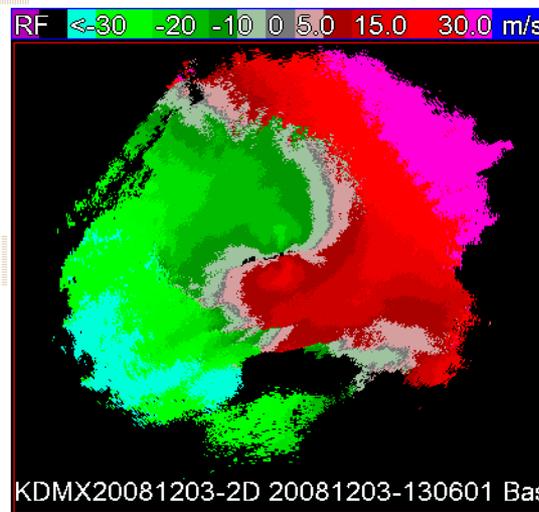
Velocity  
image from  
Baseline VDA



Velocity  
image from  
early version  
2-D VDEAL

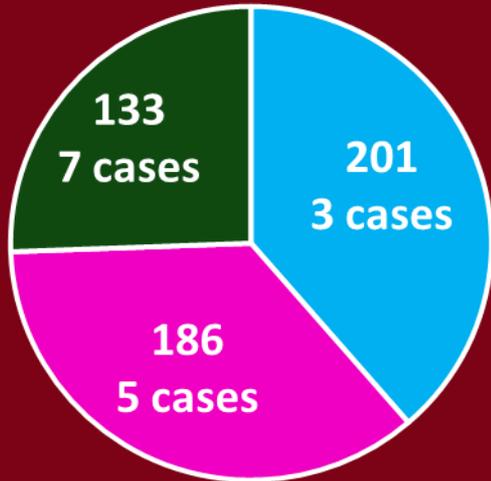


Velocity  
image from  
new version  
2-D VDEAL

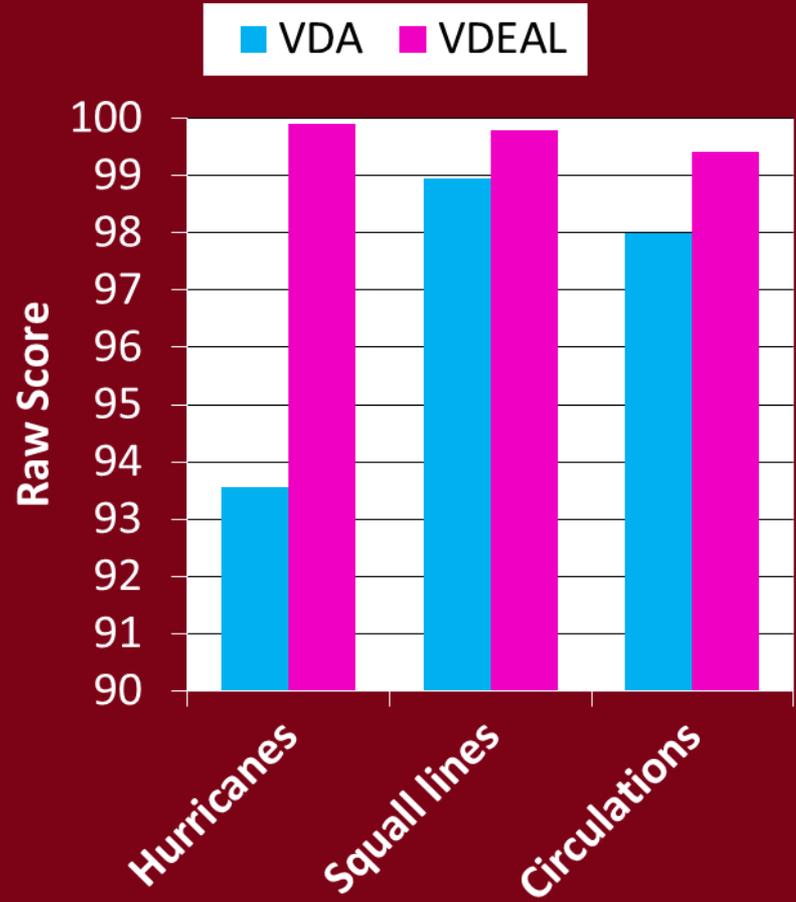


# ROC Results

## Number of Volume Scans by Category



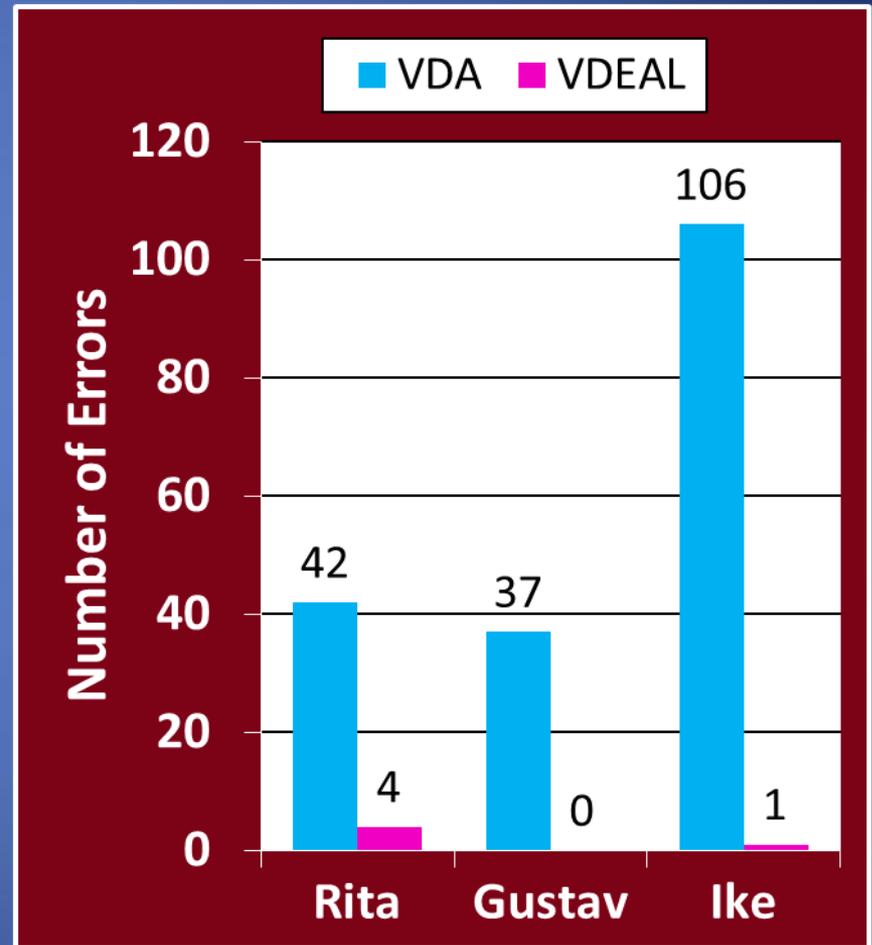
■ Hurricanes    ■ Squall Lines  
■ Circulations



# ROC Results (Cont'd)

## Hurricane Analysis

- Hurricane Rita (KLCH)
  - 24 September 2005
  - 62 Volumes
  - VCP 21
- Hurricane Gustav (KLIX)
  - 1 September 2008
  - 39 Volumes
  - VCP 212
- Hurricane Ike (KHGX)
  - 13 September 2008
  - 100 Volumes
  - VCP 212

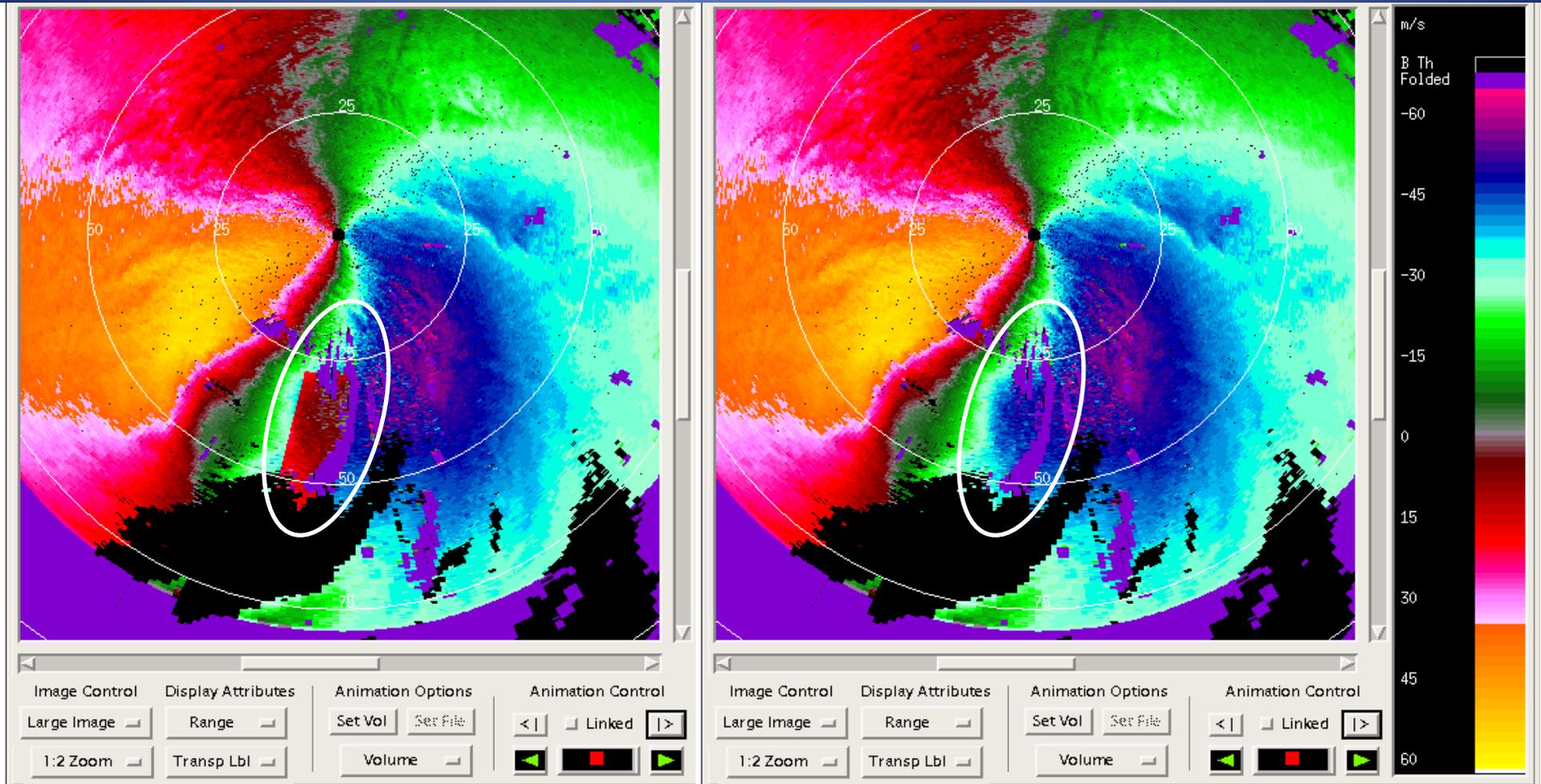


# KLCH Hurricane Rita

## 24 Sep 2005, 06:33Z, VCP 212

### Baseline VDA

### 2-D VDEAL



# KLIX Hurricane Gustav

1 Sep 2008, 13:17Z, VCP 212

Baseline VDA

2-D VDEAL

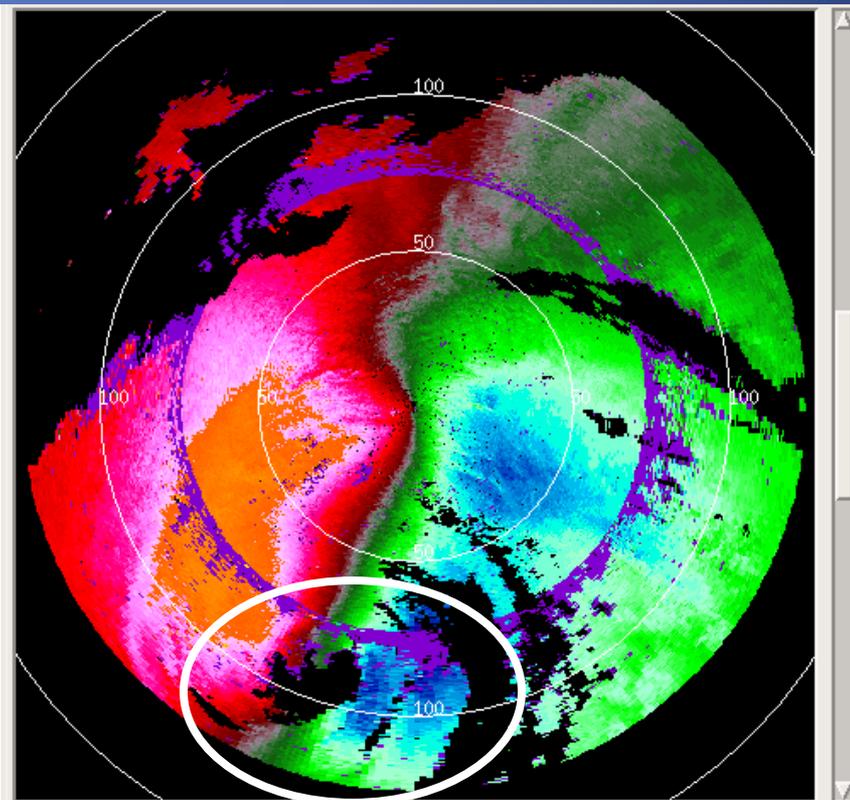
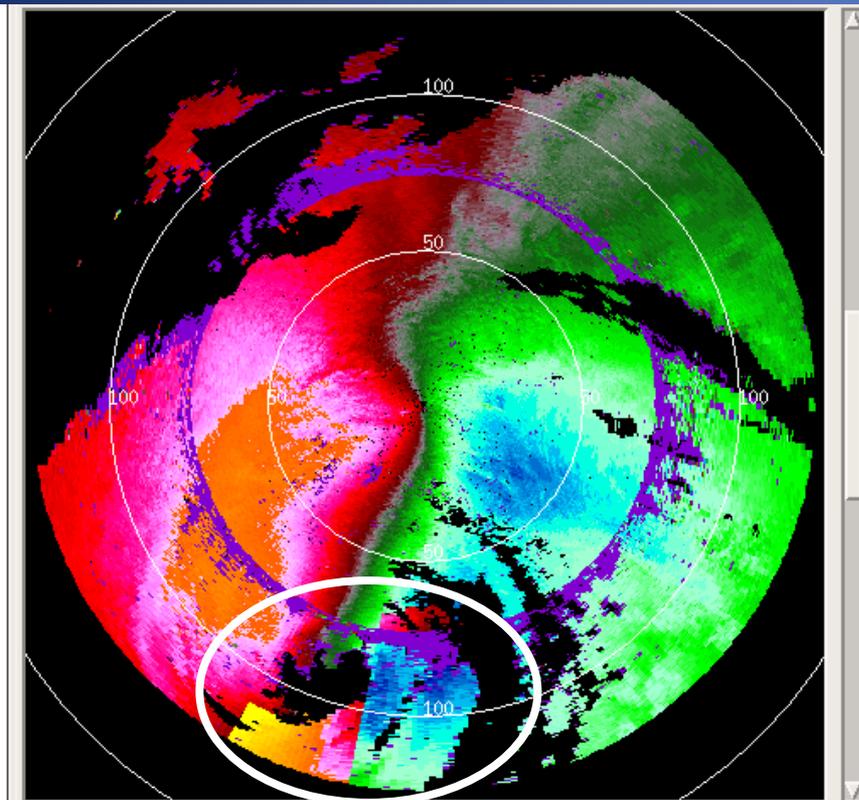


Image Control    Display Attributes    Animation Options    Animation Control

Large Image ▾    Range ▾    Set Vol    Set File    <|    Linked    |>

1:4 Zoom ▾    Transp Lbl    Volume ▾    ◀    ■    ▶

Image Control    Display Attributes    Animation Options    Animation Control

Large Image ▾    Range ▾    Set Vol    Set File    <|    Linked    |>

1:4 Zoom ▾    Transp Lbl    Volume ▾    ◀    ■    ▶

# KLIX Hurricane Gustav

1 Sep 2008, 15:16Z, VCP 212

## Baseline VDA

## 2-D VDEAL

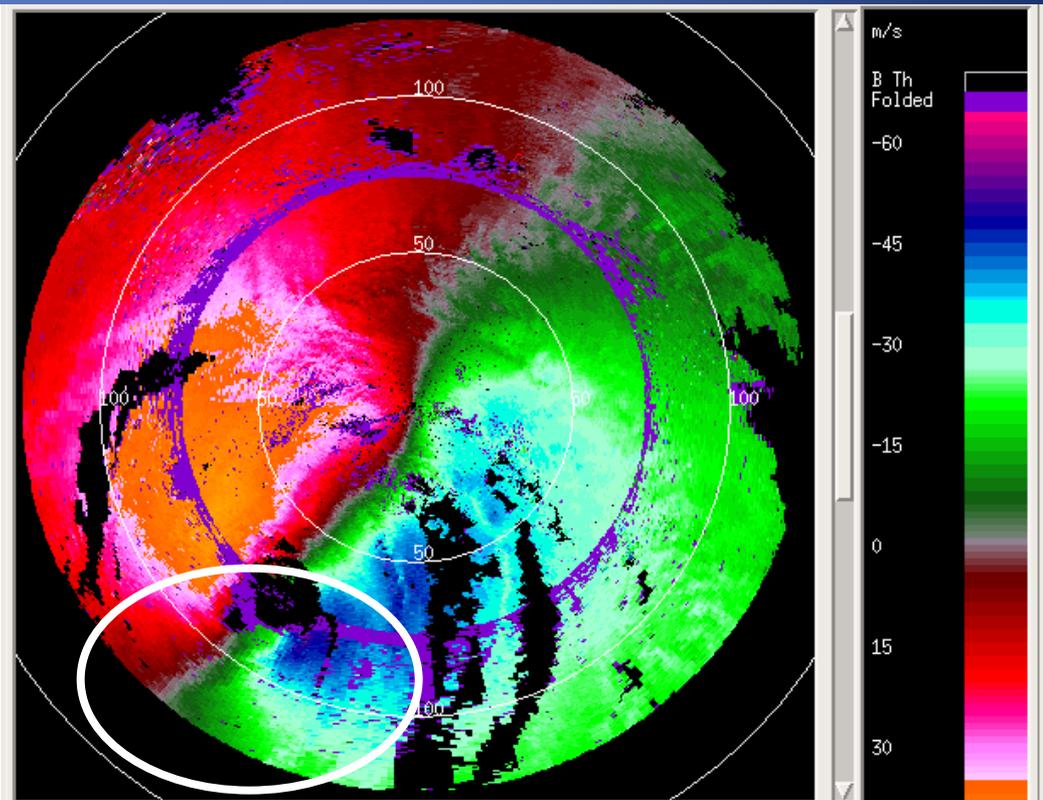
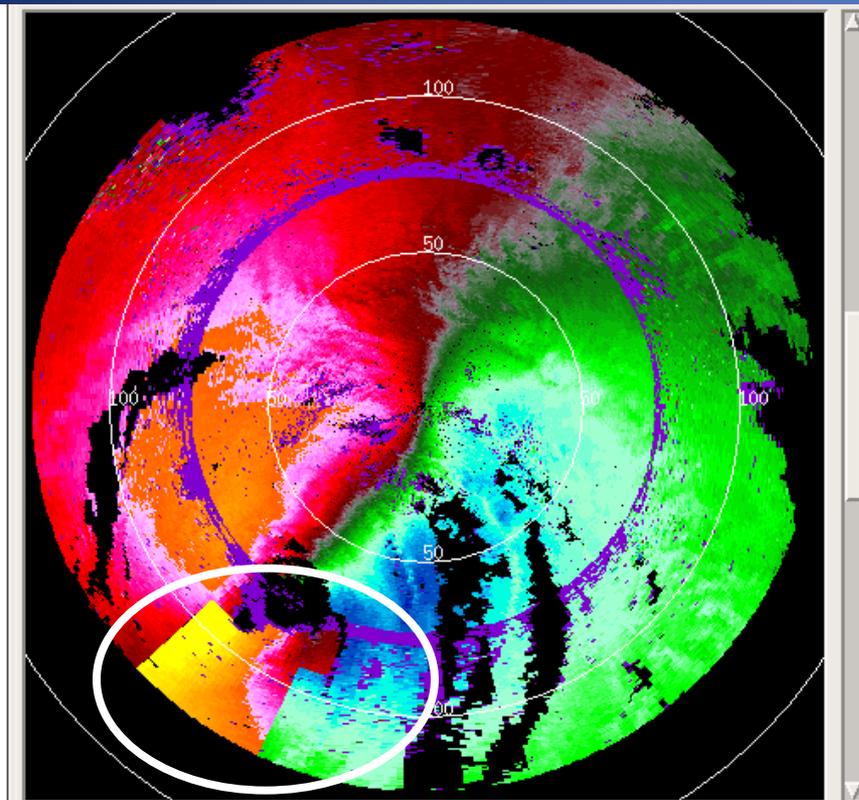


Image Control    Display Attributes    Animation Options    Animation Control

Large Image    Range    Set Vol    Set File    <|    Linked    >|

1:4 Zoom    Transp Lbl    Volume    <    >

Image Control    Display Attributes    Animation Options    Animation Control

Large Image    Range    Set Vol    Set File    <|    Linked    >|

1:4 Zoom    Transp Lbl    Volume    <    >

# KLIX Hurricane Gustav

1 Sep 2008, 16:47Z, VCP 212

## Baseline VDA

## 2-D VDEAL

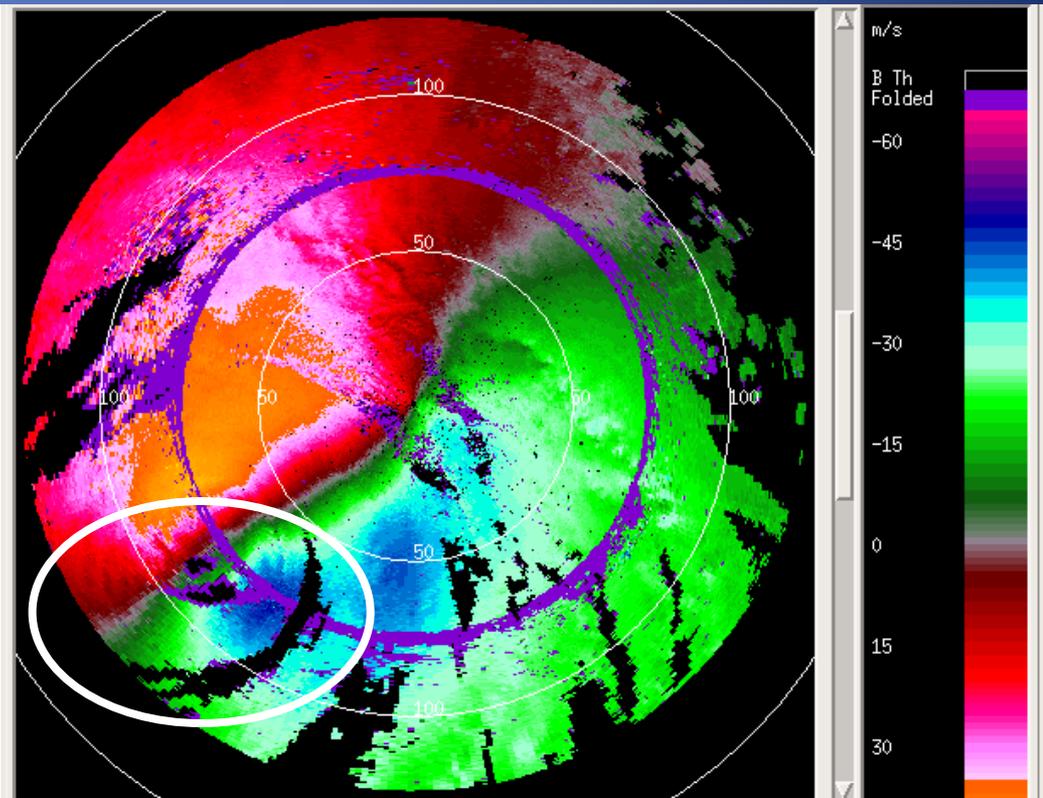
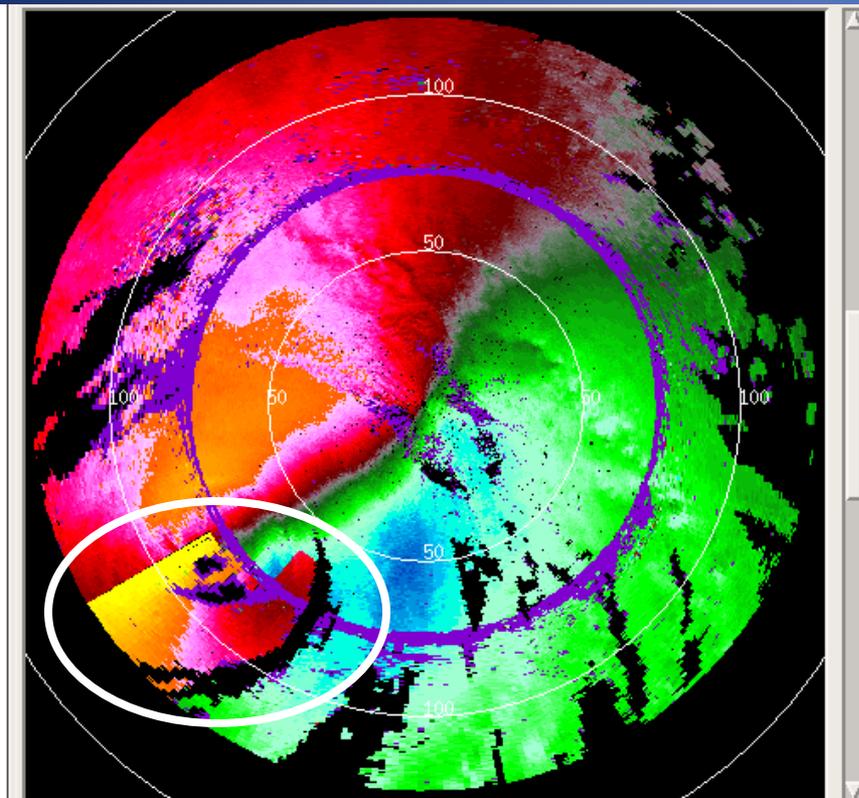


Image Control    Display Attributes    Animation Options    Animation Control

Large Image ▾    Range ▾    Set Vol    Set File    <|    Linked    |>

1:4 Zoom ▾    Transp Lbl    Volume ▾    ◀    ■    ▶

Image Control    Display Attributes    Animation Options    Animation Control

Large Image ▾    Range ▾    Set Vol    Set File    <|    Linked    |>

1:4 Zoom ▾    Transp Lbl    Volume ▾    ◀    ■    ▶

# KHGX Hurricane Ike

## 13 Sep 2008, 06:12Z, VCP 212

### Baseline VDA

### 2-D VDEAL

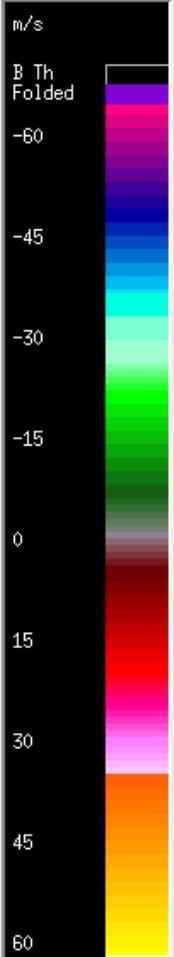
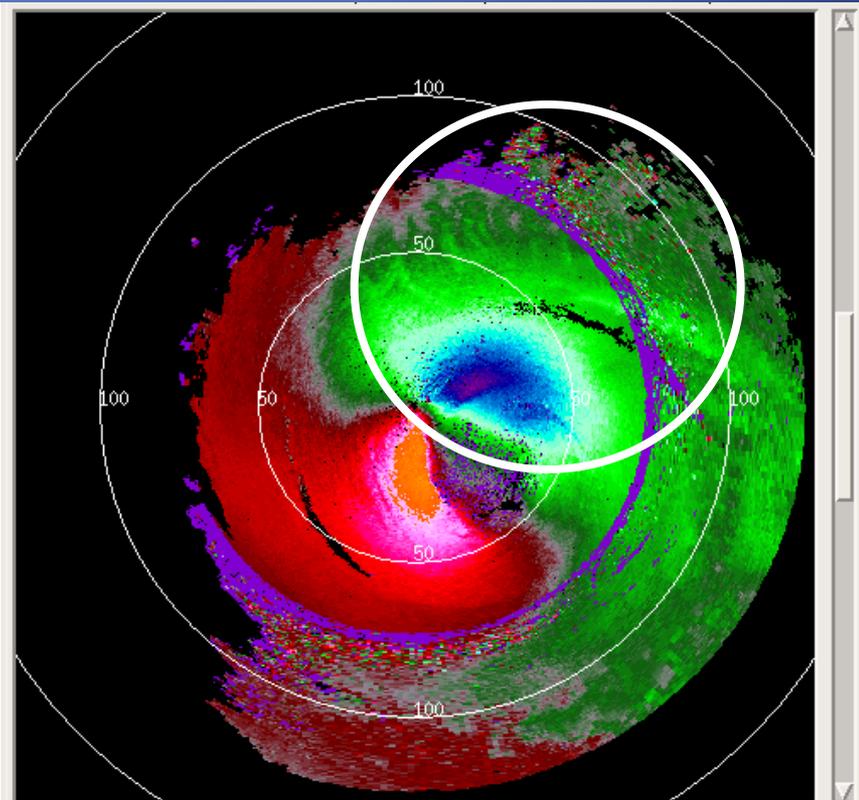
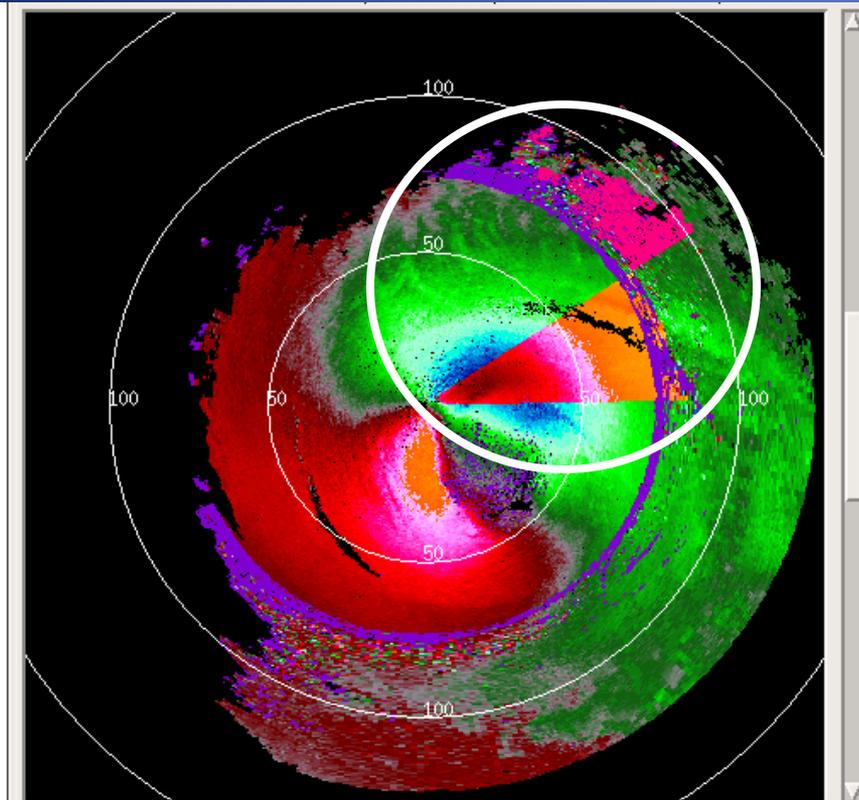


Image Control    Display Attributes    Animation Options    Animation Control

Large Image    Range    Set Vol    Set File    <|    Linked    |>

1:4 Zoom    Transp Lbl    Volume    ◀    ■    ▶

Image Control    Display Attributes    Animation Options    Animation Control

Large Image    Range    Set Vol    Set File    <|    Linked    |>

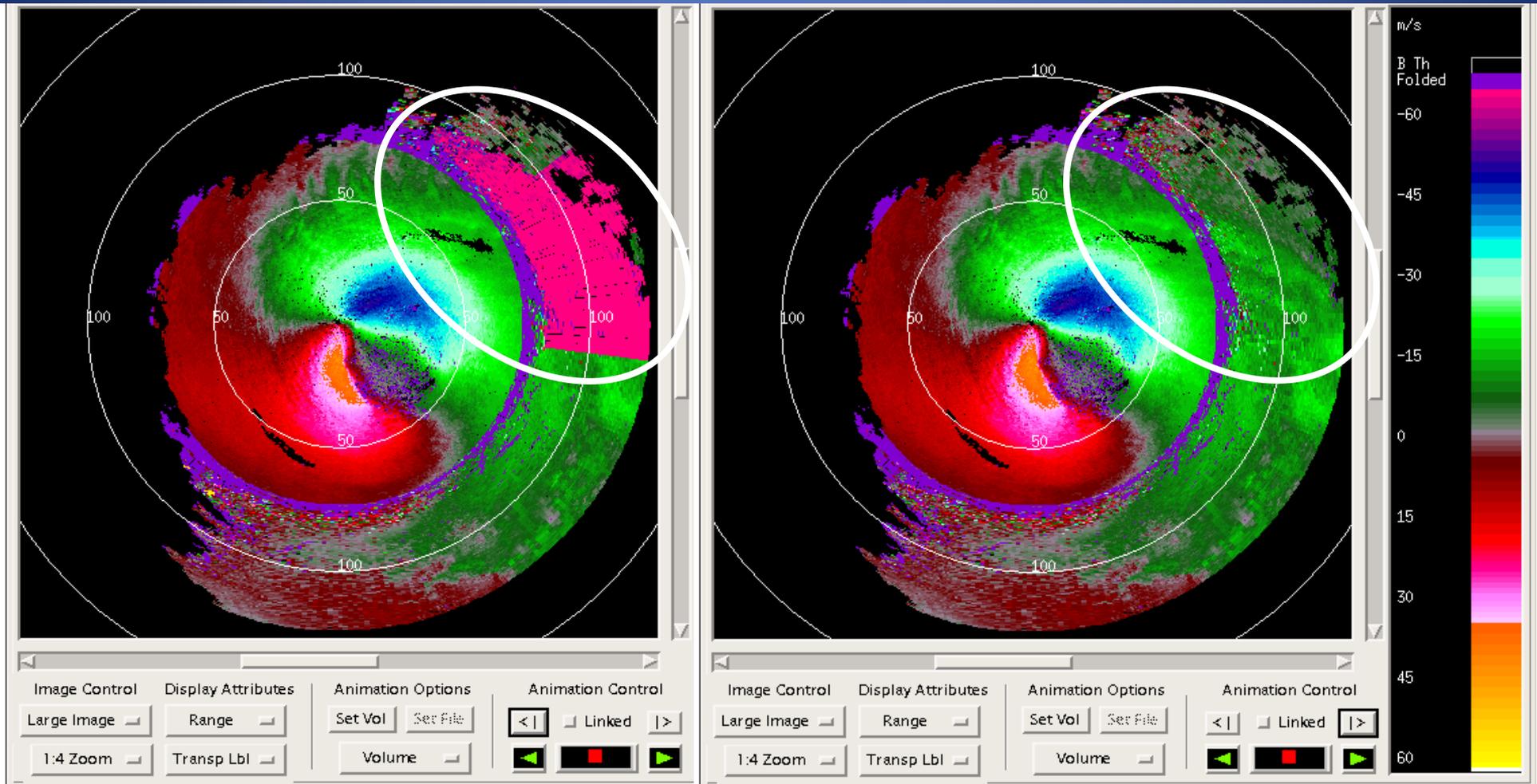
1:4 Zoom    Transp Lbl    Volume    ◀    ■    ▶

# KHGX Hurricane Ike

## 13 Sep 2008, 06:21Z, VCP 212

### Baseline VDA

### 2-D VDEAL

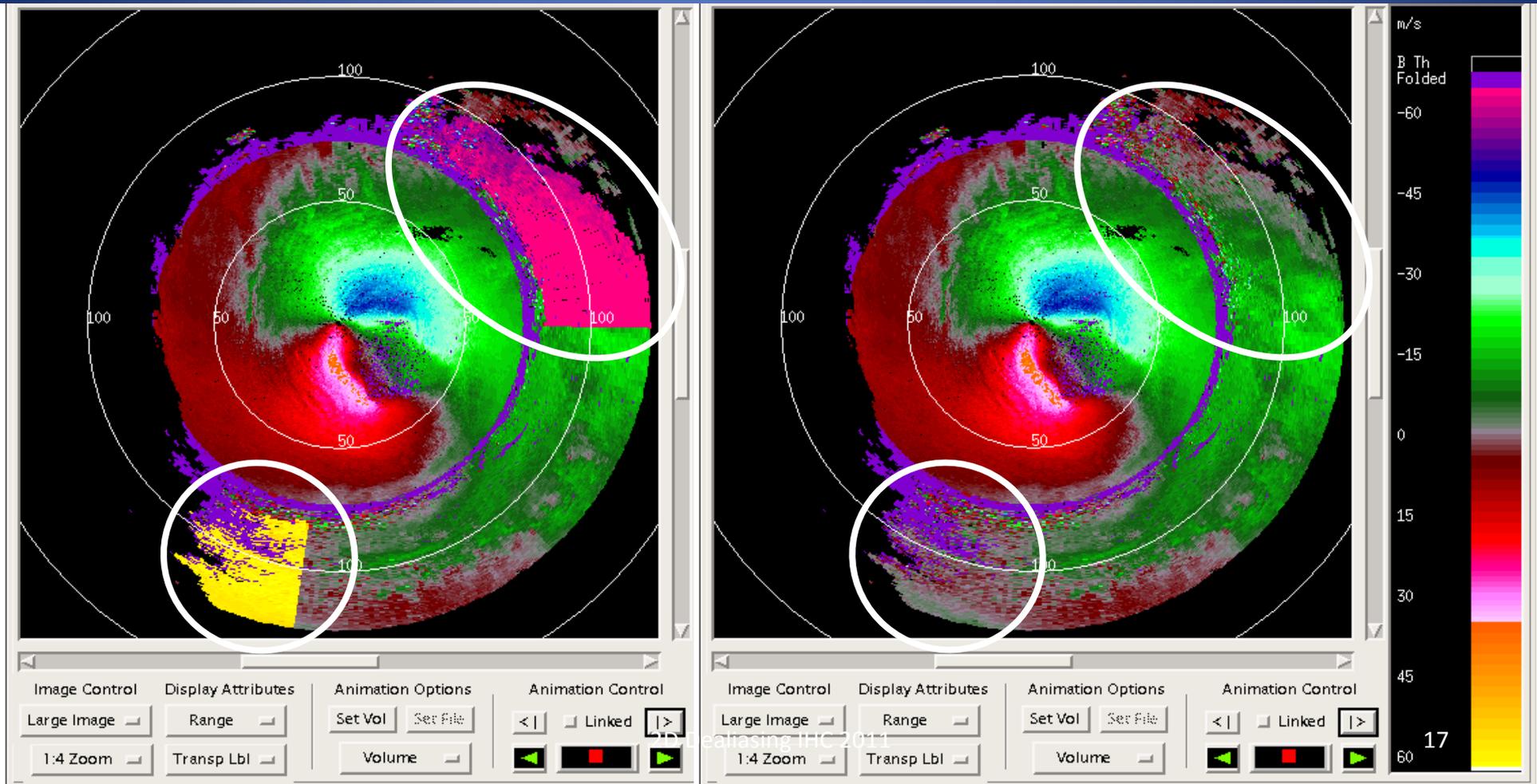


# KHGX Hurricane Ike

## 13 Sep 2008, 06:45Z, VCP 212

### Baseline VDA

### 2-D VDEAL



# Outflow Boundary, Norman, OK

## Baseline VDA

## 2-D VDEAL

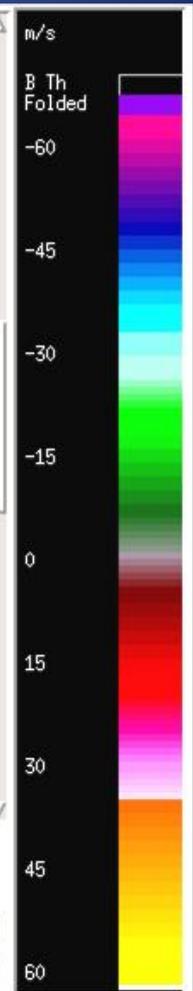
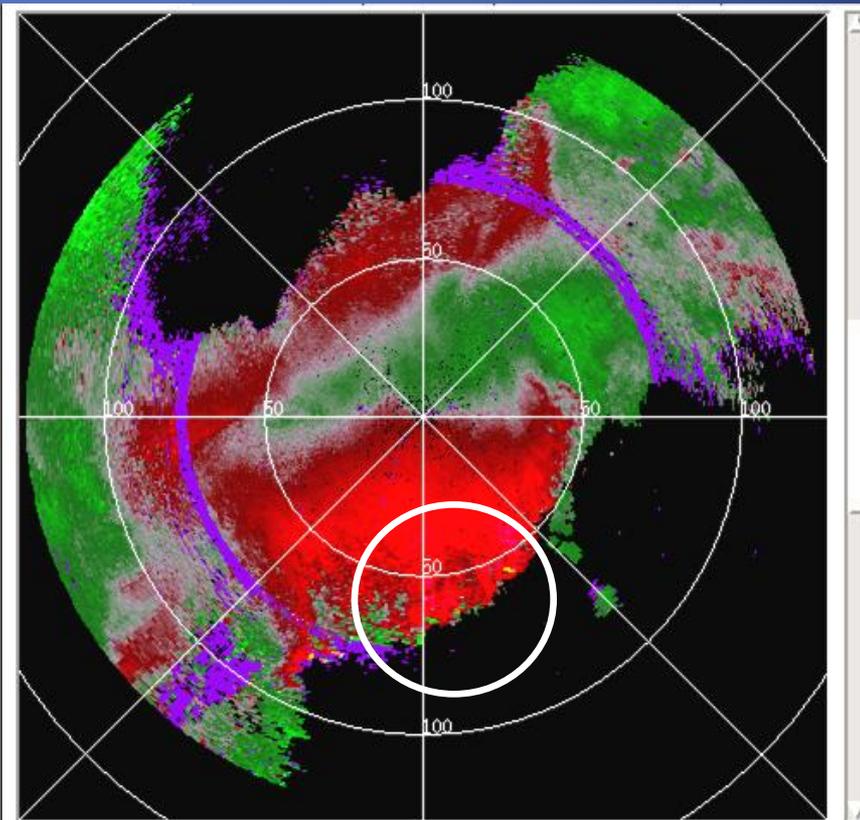
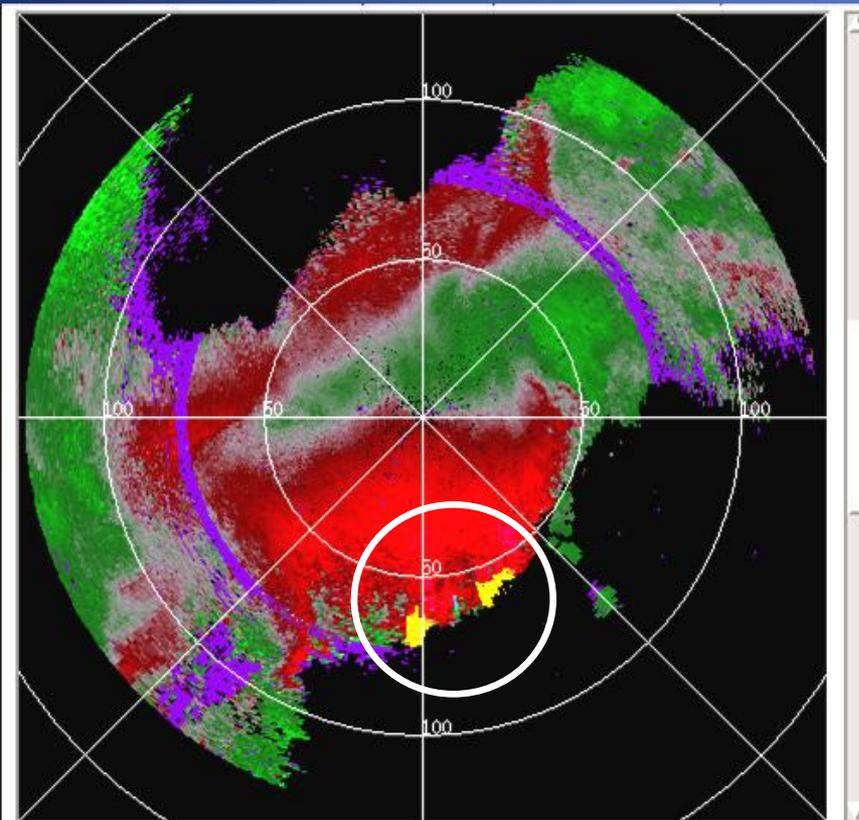


Image Control    Display Attributes    Animation Options    Animation Control

Large Image     ALL     Set Vol    Set File    < |    Linked    | >

1:4 Zoom     Transp Lbl     Volume    

Image Control    Display Attributes    Animation Options    Animation Control

Large Image     ALL     Set Vol    Set File    < |    Linked    | >

1:4 Zoom     Transp Lbl     Volume

# Field Test of VDEAL

- Field test to run 1 June to 1 December, 2011
  - Coincide with hurricane season
  - Toggle will allow sites to switch between baseline VDA and new 2-D VDEAL
  - Looking for participation from 8+ sites
    - 4+ coastal
    - 2 mountainous
    - 2 other interior sites

# Goals of VDEAL Field Test

- Obtain field experience with VDEAL at new sites under a broad range of meteorological conditions
- Obtain feedback from operational users
- Determine if VDEAL can replace the VDA for most VCPs or simply be an option

## Exceptions

- *VCP 121 will continue to use the MPDA*
- *PRF sectoring will invoke VDA*

# Tentative Field Test Schedule

- December 2010/January 2011 obtain approval ✓  
to conduct field test
- February to May 2011
  - Assemble test team ✓
  - Formulate test plans/evaluation criteria ✓
  - Solicit participation from field sites
- June 1 to December 1, 2011 – conduct field test and begin data evaluation
- December 2011 to March 2012 – conclude data evaluation, write final report, make recommendation
- If successful, determine when to deploy

# Questions?

# Supplemental Slides

# Baseline Velocity Dealiasing Algorithm (VDA)

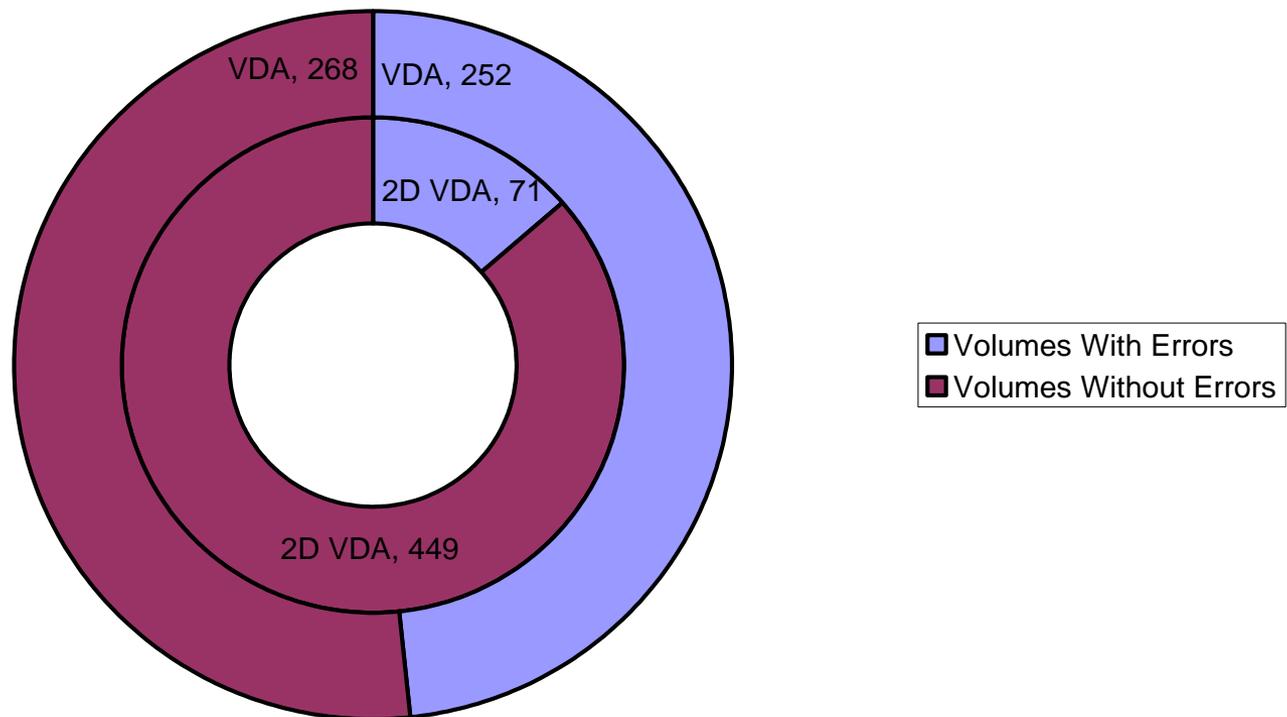
- Applies algorithm sequentially on a radial by radial basis
  - Saves a copy of last good dealiased radial
- Uses Environmental Wind Table to provide initial value for dealiasing
- Dealiasing proceeds along a radial using nearby velocity bins or an average of nearby bins that have already bin dealiased
- Checks for and attempts to correct unrealistic radial or azimuthal shears
- Assigns original velocity values to unresolved velocity bins

# Baseline Multiple PRF Dealiasing Algorithm (MPDA)

- Algorithm sequentially acquires up to 3 velocity scans each with a different Nyquist velocity at the same elevation angle
- Uses environmental wind data to help with dealiasing
- First dealiases 3 velocity values, where available, for the same point in space to find a solution
- If no solution found from previous step, dealiases pairs of velocities from the 3 estimates or if there are only 2 velocities are available
- If no solution found from the previous step, dealiases velocity data where only 1 value is available
- Finally, If no acceptable solution found, puts in the best fitting velocity from any velocity field into the dealiased velocity field
- Checks between steps for unrealistic shears and isolated bins
- Values put in the output velocity field provide reference values for downstream dealiasing

# Bulk Statistics VDA vs VDEAL from Applications Branch Study

2D VDA v. Current VDA Comparison of Volumes With and Without Dealiasing Errors



# NSSL Results (Cont'd)

KDMX, December 3, 2008, VCP 31  
Light Precipitation w/Frontal Boundary

