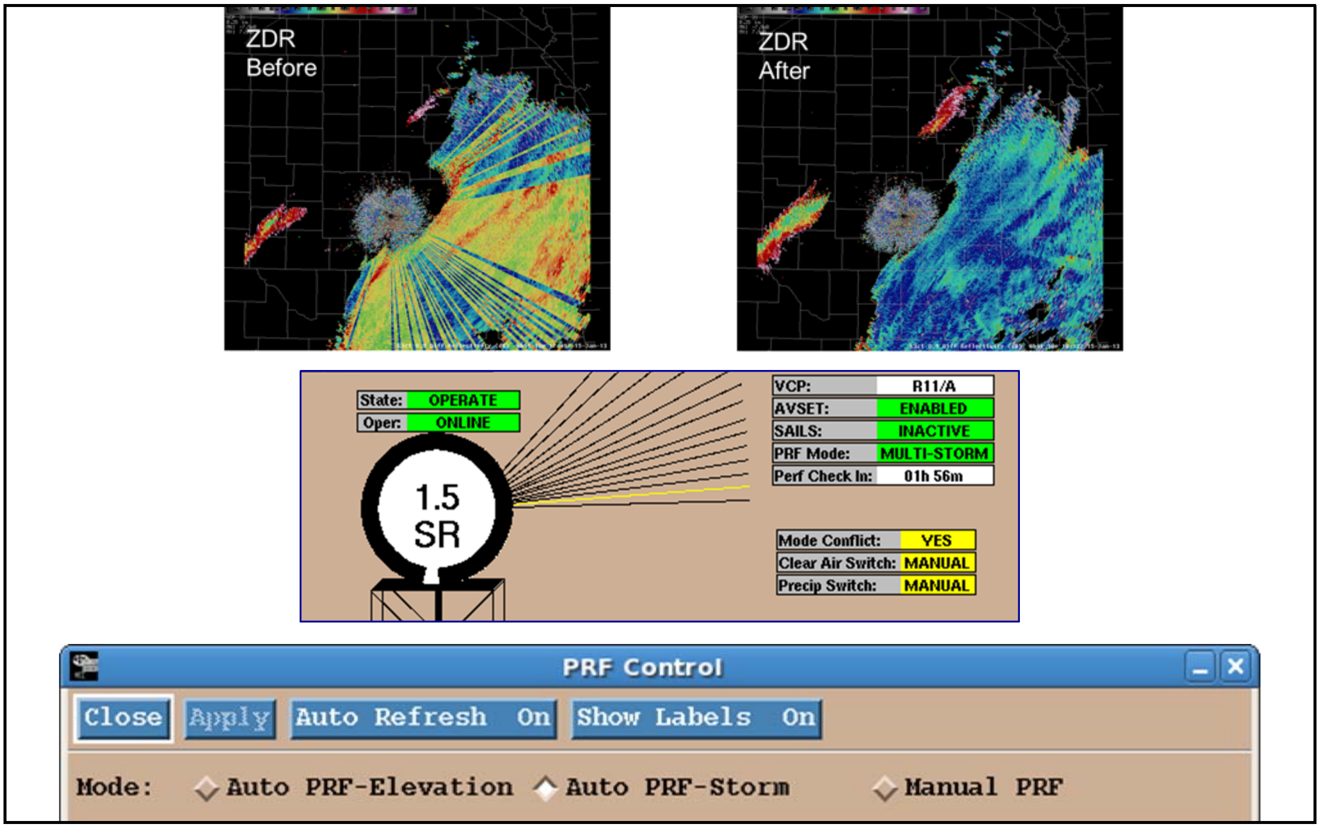
RDA/RPG Build 14.0

Training



Presented by the
Warning Decision Training Branch

Version: 1404

Overview

Build 14.0 upgrades software at both the RDA and RPG and this document presents the associated operational changes. The most significant impacts of this build, requiring operator intervention for best performance, are the RPG changes known as Supplemental Adaptive Intra-Volume Low-Level Scan (SAILS), and Storm-Based Auto PRF. These features allow for more rapid low level product updates (SAILS), and better tools to prevent range folding from obscuring velocity data for storms of interest (Storm-Based Auto PRF).

Unit Radar Committee

The Build 14.0 changes at both the RDA and the RPG may affect Unit Radar Committee (URC) decision making. Coordination among URC members with respect to how Build 14.0 impacts URC protocols is encouraged.

The information presented in this document reflects the pre-Deployment state of knowledge of the operational impacts of Build 14.0.

Please note that most of the radar products in this document were captured from GR Analyst and are thus built directly from the Level II data. The data (especially dual-pol) are noisier in appearance than the associated RPG generated versions would be if viewed in AWIPS.

RDA/RPG Build 14.0 Operational Impacts

The following Build 14.0 operational changes are presented in this document:

- Initial System Differential Phase (ISDP)
- Radial by Radial (RxR) Noise Estimation
- Coherency Based Thresholding (CBT)
- 8 Hour Performance Check Countdown

- Improved Calibration Information
- Supplemental Adaptive Intra-Volume Low-Level Scan (SAILS)
- Update to the Automated Volume Scan Evaluation and Termination (AVSET) Algorithm
- Storm-Based Auto PRF
- Auto PRF for SZ-2 VCPs
- Dual-Pol RPG Algorithm Adjustments

Initial System Differential Phase (ISDP)

Differential Phase (ϕ_{DP}), one of the building blocks for the dual-pol variables, is used in the calculation for both Correlation Coefficient (CC) and Specific Differential Phase (KDP). ϕ_{DP} is not generated as a product at the RPG, thus is not viewable in AWIPS. However, it is available as level 2 base data and displayable through viewers such as GR Analyst (Figure 1).

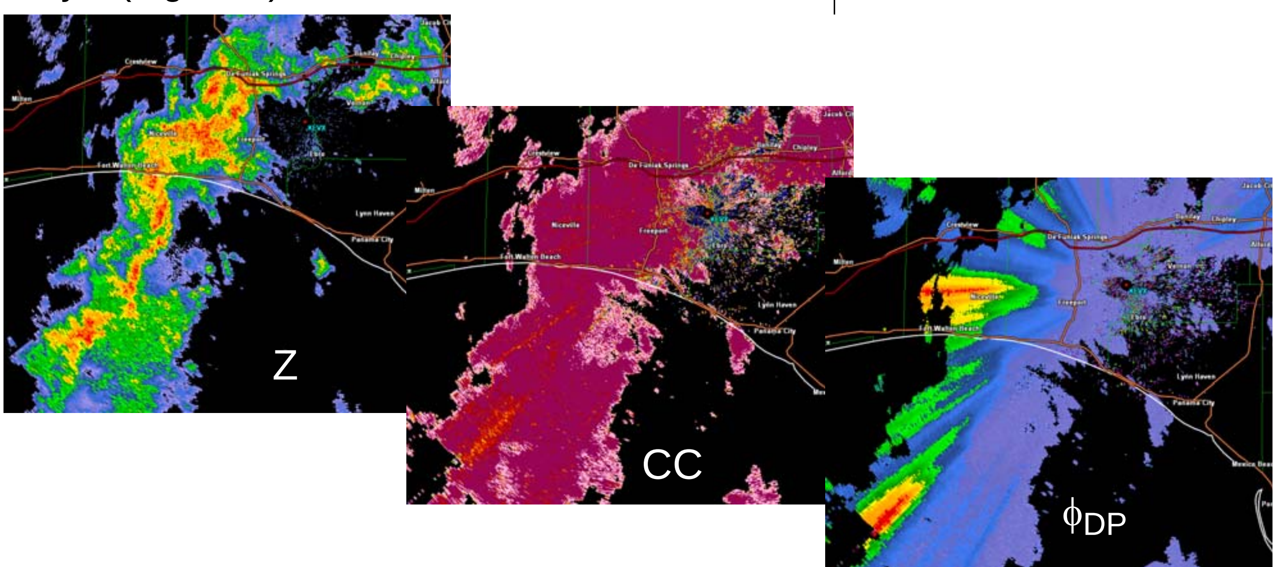


Figure 1. Z, CC, and ϕ_{DP} displayed in GR Analyst.

Meteorologists are interested in the value of ϕ_{DP} as it passes through precipitation, since the change in ϕ_{DP} is directly related to the amount of liquid water content within the beam. However, system hardware also contributes to ϕ_{DP}, and “system ϕ_{DP}“ must be accounted for.

The Role of the ISDP

As the radar beam travels from the RDA, ideally there would be zero change in ϕ_{DP} in clear air, with ϕ_{DP} only increasing based on liquid water content as the beam passes through precipitation. This situation is often compromised by residual clutter, biological targets, and phase shifts induced within the radar. The Initial System Differential Phase (ISDP) is a preferred value of ϕ_{DP} as the beam first enters precipitation along a radial. There are two different RDA parameters that account for system ϕ_{DP} with the goal of having ϕ_{DP} = 60° as the radar beam first encounters precipitation.

A brief, off-line process, the ISDP Calibration, must be run periodically to ensure that the ISDP functions as intended. If this off-line ISDP process is not run, the dual-pol data quality can become seriously compromised over time. A poor ISDP affects the dual-pol variables (Figure 2), and thus the output from the RPG algorithms, such as the Quantitative Precipitation Estimation (QPE) rainfall estimates. It is important to prevent ϕ_{DP} from reaching 0° or 360°, which results in “wrapping” (similar to velocity aliasing). Figure 2 presents images of Differential Reflectivity (ZDR) before (left) and after (right) the ISDP Calibration was performed. The streaks in ZDR are the result of ϕ_{DP} wrapping, which can be avoided by performing the ISDP Calibration.

Why is ZDR Affected by ϕ_{DP}?

Though ϕ_{DP} is not part of the ZDR computation at the RDA, ZDR values are adjusted by the Dual-Pol Preprocessor at the RPG. The Preprocessor uses ϕ_{DP} to correct ZDR for attenuation. If ϕ_{DP} wrapping

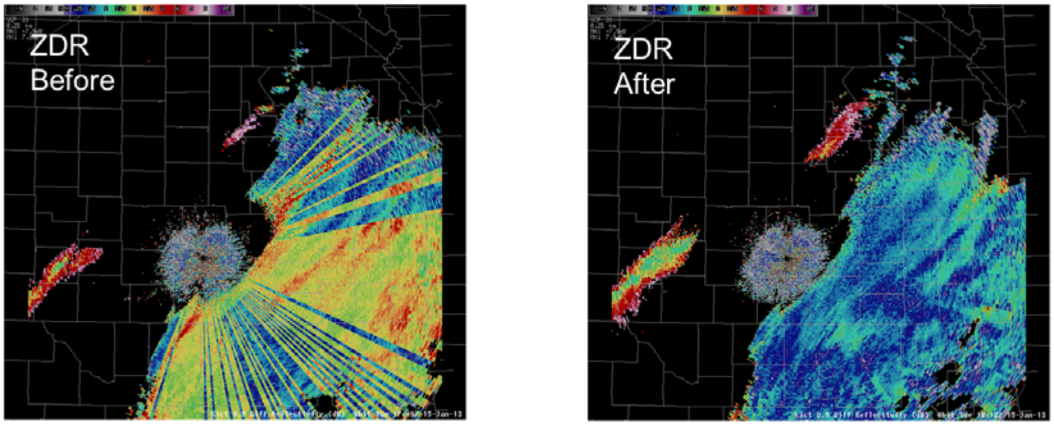


Figure 2. ZDR before and after the ISDP Calibration procedure.

is occurring, an attenuation over-correction can cause streaks in ZDR.

Why 60°?

The change with Build 14.0 related to the ISDP Calibration is that the goal for entering precipitation is ϕ_{DP} = 60°, instead of the previous value of 25°. An ISDP of 60° is intended to reduce the risk of ϕ_{DP} going below 0°, as well as reaching 360°. The goal is to make the need to run the ISDP Calibration as infrequent as possible. It is not necessary to run the ISDP Calibration when the software is upgraded to Build 14.0.

When looking at the ϕ_{DP} base data in a Level 2 viewer, such as GR Analyst, look for values of about 60° along the leading edge of rainfall. Note that this Build 14.0 change from 25° to 60° may look much different, depending on the color tables in your viewer. The ROC has provided a guidance document to support technicians and meteorologists working together to support the ISDP process. A link to this content (and other references) is available from the WDTB RDA/RPG Build 14.0 Training web site:

http://www.wdtb.noaa.gov/buildTraining/Build14

RPG Status Window

There is system ϕ_{DP} information included in an RPG status message every 4 hours (Figure 3). This information is not intended for operational use. It is used for engineering evaluation, which may lead to an improved process (made available in a later WSR-88D build) for assigning more accurate ϕ_{DP} in both clear air and precipitation.

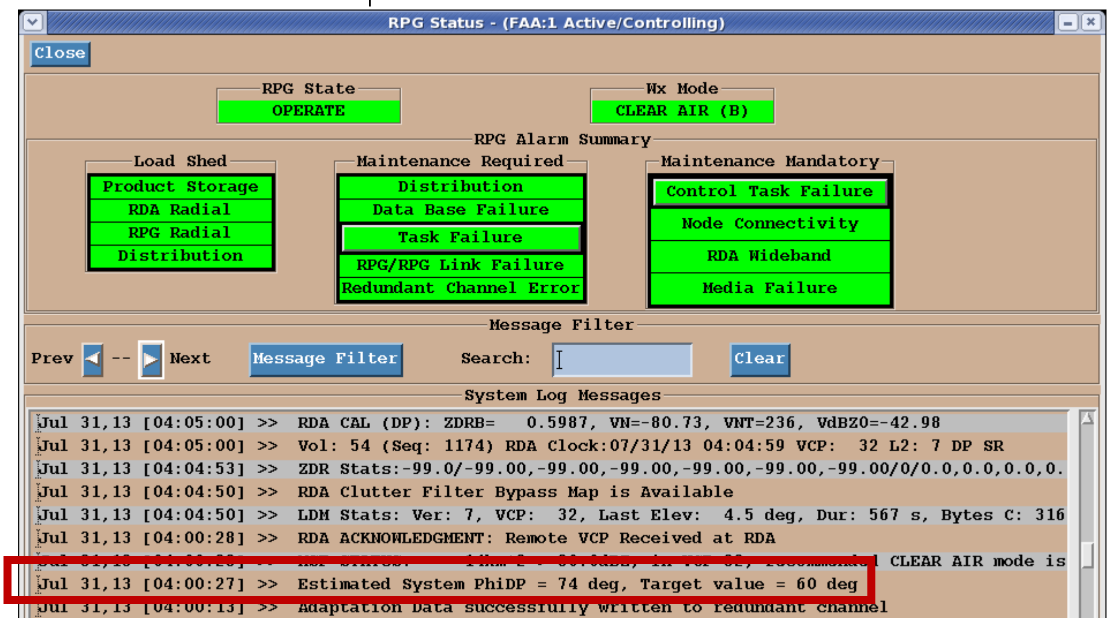


Figure 3. RPG Status screen with ISDP related status message.

Radial by Radial Noise Estimation

The Role of System Noise

There are multiple sources of noise that must be accounted for with weather radars, both within the radar hardware, as well as from the atmosphere (Figure 4). Estimating noise accurately is a significant contributor to base data quality. For example, an overestimate of noise reduces radar sensitivity, i.e. a weak returned power weather signal cannot be distinguished from the noise.

Dual-Pol Variables and Noise

The dual-pol variables, Differential Reflectivity (ZDR), Correlation Coefficient (CC), and Specific Differential Phase (KDP), are more reliant on

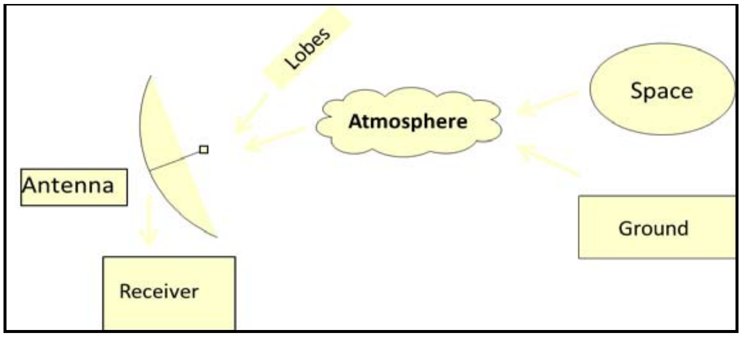


Figure 4. The multiple contributors to radar noise.

accurate noise estimates than the legacy base data, Reflectivity (Z), Velocity (V), and Spectrum Width (SW). The "pink fringe" on CC in areas of weak signal is indicative of this reliance on accurate noise estimates (Figure 5).

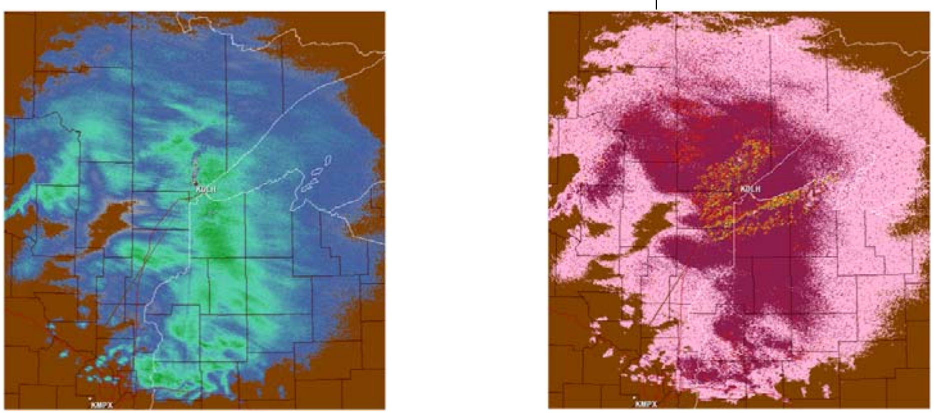


Figure 5. "Pink fringe" on CC in areas of weak signal.

Though the pink fringe can sometimes be widespread, it is ***not*** an indication of a problem with the WSR-88D. The dual-pol variables in general, and CC in particular, are more difficult to calculate accurately in weak signal areas. The pink fringe is an indicator of the lower reliability of the dual-pol data in these weak returned signal areas.

Goal of Radial by Radial Noise Estimation

The goal of Radial by Radial (RxR) Noise Estimation is to provide a ***more accurate*** noise estimate. This will not necessarily result in a ***lower*** noise estimate for every radar. Differences on the radar images during testing have usually been subtle (Figure 6).

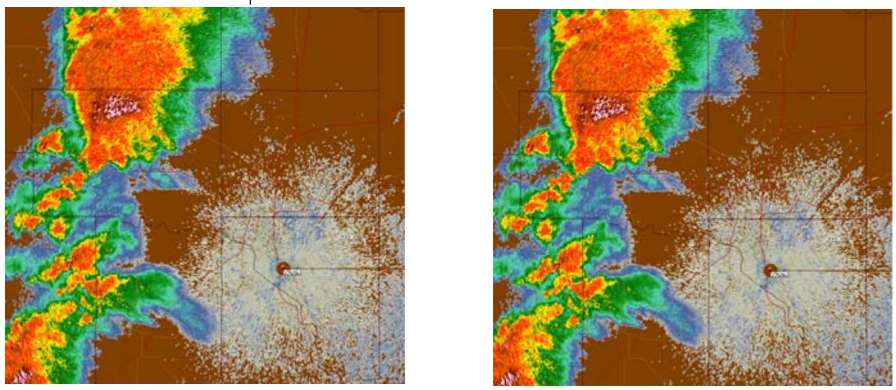


Figure 6. Radial by Radial Noise Off (left) vs. On (right) for Z, with very little difference.

For each radial, “noise-like” bins are identified, and the average noise value is used for that radial. A minimum number of consecutive noise-like bins is needed for this average, and if the minimum is not available, a default noise value is used. RxR Noise Estimation will not necessarily decrease the “pink fringe” on CC, but it can improve the availability of valid CC in weak signal events, such as winter weather. In Figure 7, RxR Noise Estimation is disabled on the left and enabled on the right.

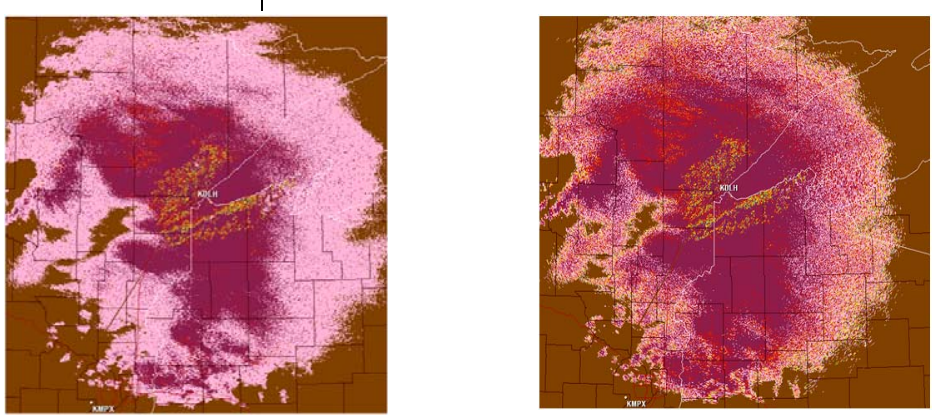


Figure 7. “Pink fringe” on CC in areas of weak signal with a winter event. RxR Noise Estimation is disabled (left) and enabled (right).

Interference

Though this was ***not*** the goal of RxR Noise Estimation, the technique often reduces the display of some types of interference. Sunrise and sunset spikes are good examples of numerous bins along a radial with strong "noise-like" characteristics. RxR Noise Estimation can identify the high noise level, and threshold the returns from this type of interference such that they are not assigned to the base data.

Figure 8 has an example of interference (left) that is not visible with RxR Noise Estimation Enabled (right). Though many types of interference will be seen less often with RDA Build 14.0, there are cases where they will be partially visible.

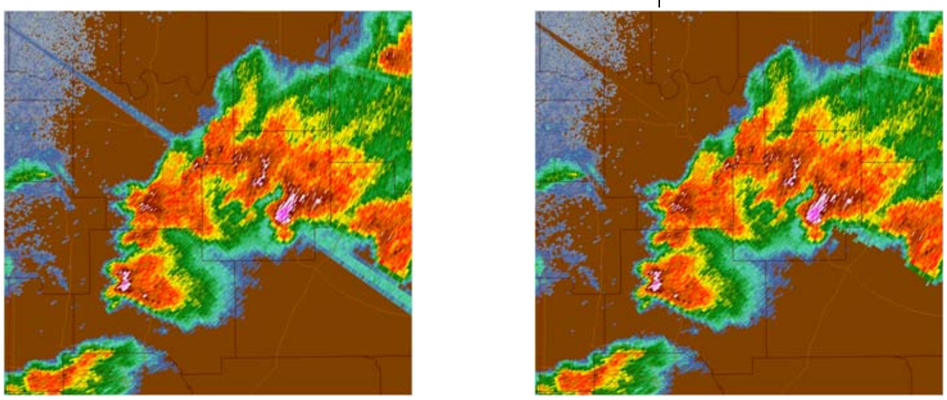


Figure 8. Interference noise (left) that is identified by the RxR Noise Estimator (right).

Coherency-Based Thresholding (CBT)

Coherency-Based Thresholding (CBT) is another Build 14.0 RDA technique that has a generally subtle effect on the radar products. CBT does ***not*** change the way the base data are processed, only the way it is thresholded. Thresholding determines which bins of data are visible on products. Currently CBT is only applied to the Split Cut elevations. It is not applied to the Batch elevations, since the number of pulses is too low.

CBT is performed after RxR Noise Estimation. The goal of CBT is to improve detection of the radar by allowing some very weak signal data to be displayed. The weak signal must be coherent, i.e. the CC is high enough and the SW is low enough for the data to be considered valid. The majority of cases from CBT testing revealed a slight increase in areal coverage on the fringes of precipitation and areas of clear air return. Figure 9 provides a typical example (CBT disabled on the left, CBT enabled on the right).

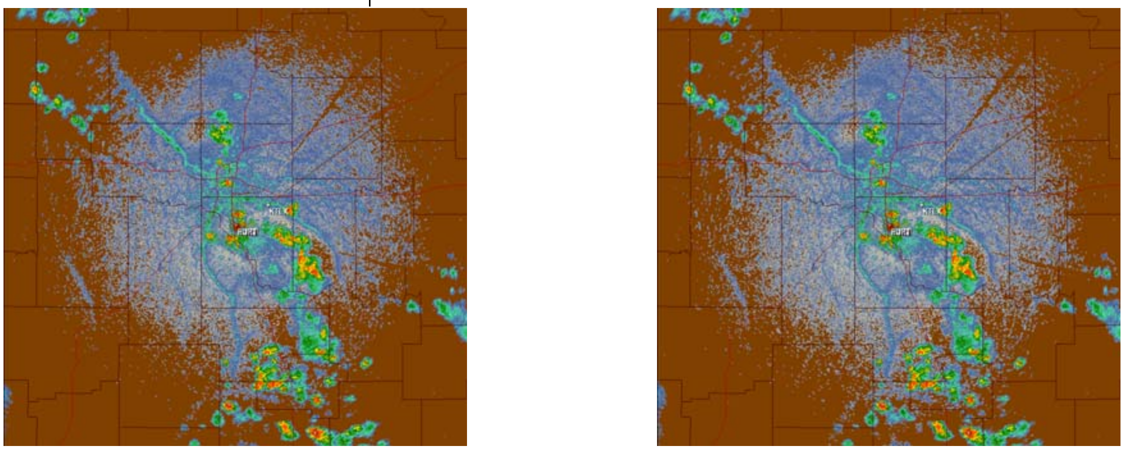


Figure 9. CBT disabled (left) vs. enabled (right) for base reflectivity

CBT may be beneficial for winter events such as lake effect snow or freezing drizzle. Any benefit will be more apparent on the legacy base products, Z, V, and SW, than the dual-pol base products (ZDR, CC, and KDP). Figure 10 provides an example of reflectivity products with CBT disabled on the left and CBT enabled on the right during a snow event.

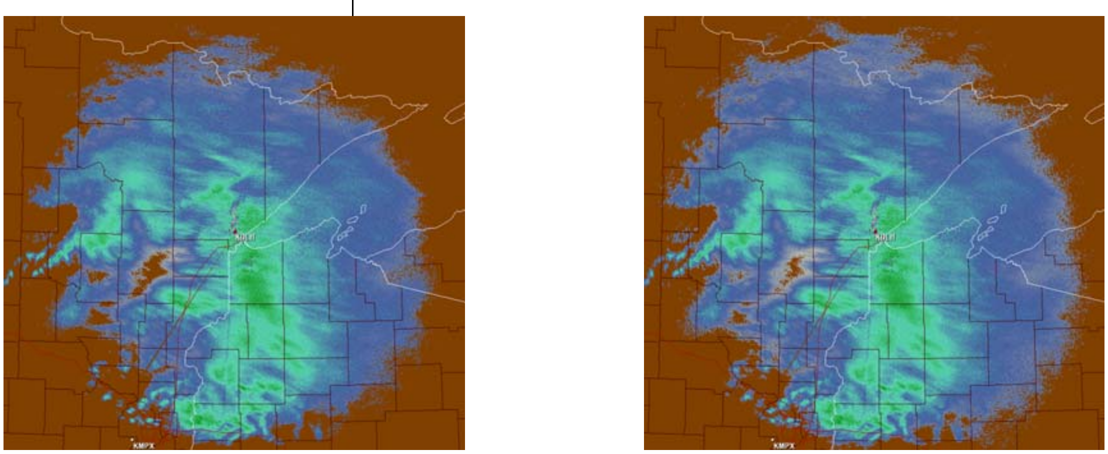


Figure 10. CBT disabled (left) vs. enabled (right) for base reflectivity during a snow event. Note the increase in areal coverage along the edges where the signal is weak.

CBT and CC

As with RxR Noise Estimation, any change in the areal coverage of “pink fringe” on CC products due to CBT will vary from site to site and event to event. Since only the most coherent signal is retained by CBT, it does not necessarily increase the pink fringe. However, the examples used during CBT testing usually had a slight increase in the pink fringe. Figure 11 is an example of CC with CBT disabled on the left and CBT enabled on the right during the snow event shown in Figure 10.

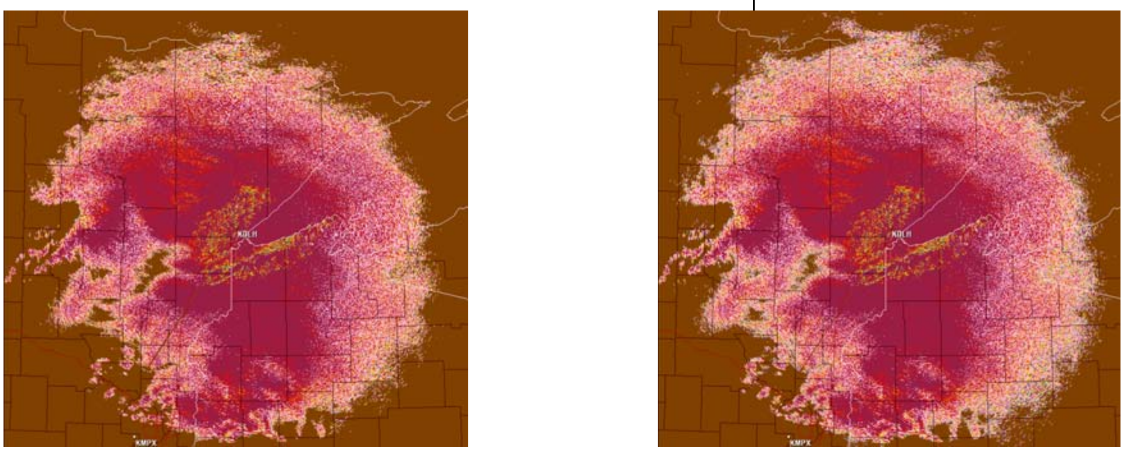


Figure 11. CBT disabled (left) vs. enabled (right) for CC during a snow event. Note the increase in areal coverage along the edges where the signal is weak.

CBT and Velocity Data

The increased availability of legacy base data with CBT may also ***slightly*** increase the availability of wind barbs on the VAD Wind Profile (VWP) product.

RxR Noise Estimation and CBT Key Points

- Compared to the legacy base data (Z, V, SW), the dual-pol variables (ZDR, CC, and KDP) are inherently noisier and less reliable in weak signal areas. Since both RxR Noise Estimation and CBT mainly affect weak signal areas, there are differences in their impacts on legacy vs. dual-pol base data.

- CBT increases the availability of ***all*** the base data in weak signal areas. Any benefit is more likely to be realized in the legacy base data, compared to the dual-pol variables.

  - CBT will likely improve detection of light snow, and freezing drizzle on Z and V, ***especially*** when using VCP 31.
  - CBT may slightly increase the number of wind barbs available on the VWP.
- CC and the “Pink Fringe”
  - RxR Noise Estimation provides a more accurate noise estimate. This will ***often*** reduce the pink fringe, but not ***always***.
  - CBT recovers more of the weak signal that would be lost due to a low Signal to Noise Ratio (SNR). This ***may or may not*** increase the pink fringe.
- Effects of RxR Noise Estimation and CBT are usually subtle, and likely not noticeable for the majority of events.

Implementation of RxR Noise Estimation and CBT

There is a difference in the implementation of these two RDA Build 14.0 improvements. RxR Noise Estimation has a default setting of Enabled, while CBT has a default setting of Disabled. Both of these features can be enabled or disabled at the RDA HCI (Figure 12). Once the state of CBT or RxR Noise is changed, the change will remain even after an RDA restart. Meteorologists rarely use the RDA HCI, and it is recommended that they work with the technicians to make decisions regarding CBT or RxR Noise Estimation.

8 Hour Performance Check Countdown

The dual-pol upgrade had a significant impact on the 8 Hour Performance Check. You were likely unaware of this on-line “radar health check” before the dual-pol upgrade, because it added very little time to the volume scan (<30 seconds). However, with dual-pol, the list of things that need checking has increased. This means that the time to complete the 8 Hour Performance Check with dual-pol is now around 2 minutes.

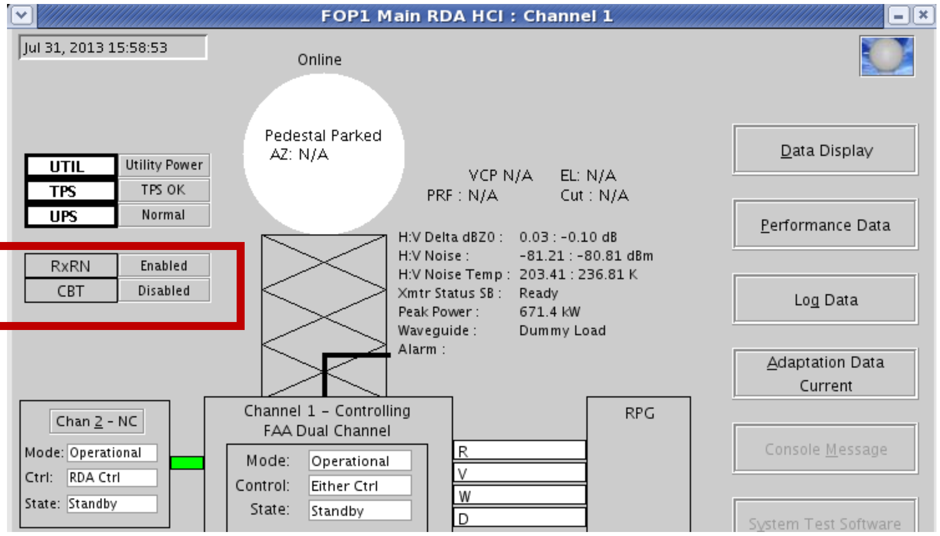


Figure 12. RDA HCI with Enable/Disable buttons for RxR Noise Estimation and CBT.

It is possible that this more lengthy on-line checkup could occur during severe weather, delaying critical products. Build 14.0 provides a "countdown" on the RPG Main HCI, allowing you to monitor when the next 8 Hour Performance Check is going to occur. The "Perf Check In:" button is located to the right of the VCP graphic (Figure 13), along with the buttons that control AVSET, and new features of Build 14.0, which will be presented in this training.

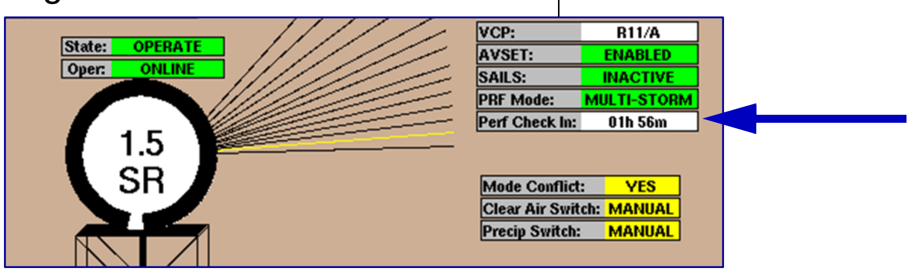


Figure 13. The Performance Check countdown button, "Perf Check In:"

When the 8 Hour Performance Check is more than one hour away, the "Perf Check In:" button has a white background, as in Figure 13. When the 8 Hour Performance Check is less than 1 hour away, the button has a yellow background (Figure 14).

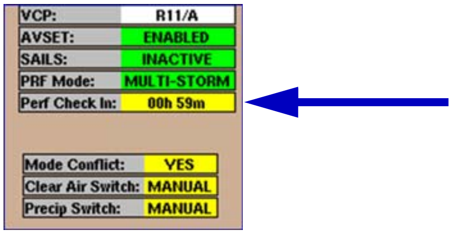


Figure 14. The Performance Check countdown button when the time remaining is less than 1 hour.

Once the 8 Hour Performance Check is less than 1 minute away, the "Perf Check In:" button background changes to green, and the status changes to PENDING (Figure 15, top image). The check will occur at the end of the current volume scan. In the example in Figure 15, AVSET is on with VCP 211 active, and the last angle for this volume scan is 6.2°. While the 8 Hour Performance Check is occurring (Figure 15, bottom), the radar graphic on the RPG HCI will remain frozen, showing the highest elevation angle, and the "Perf Check In:" status remains at PENDING.

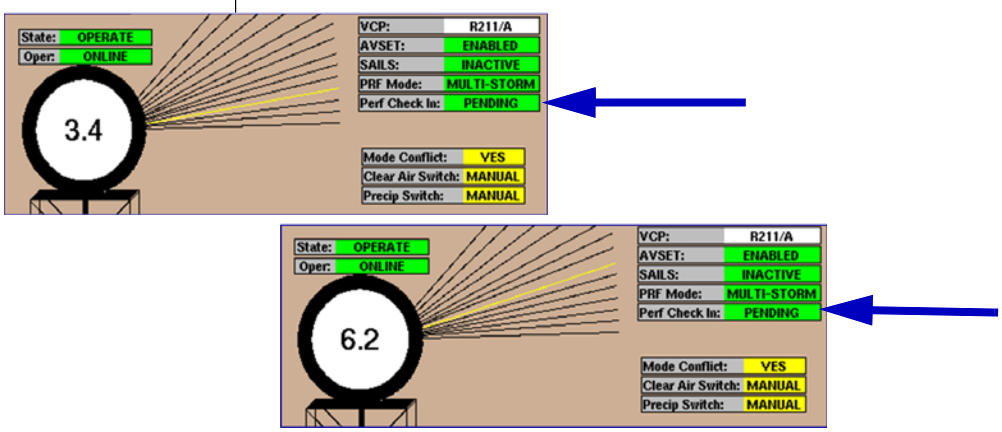


Figure 15. The Performance Check countdown button when the time remaining becomes less than 1 minute (top), and while the check is taking place (bottom).

Manually Initiating an 8 Hour Performance Check

The 8 Hour Performance Check can be manually initiated through the RPG HCI. This may be a good option when severe weather is soon expected, and the automatic check could interfere with operations. The check is manually commanded with the "Initiate Performance Check" button on the RDA Control window and will be performed at the end of the volume scan (Figure 16). The RDA Control window can be easily accessed by clicking on the status area of the "Perf Check In" on the RPG HCI Main Page. Once the Performance Check is completed, the count-down clock resets to 8 hours.

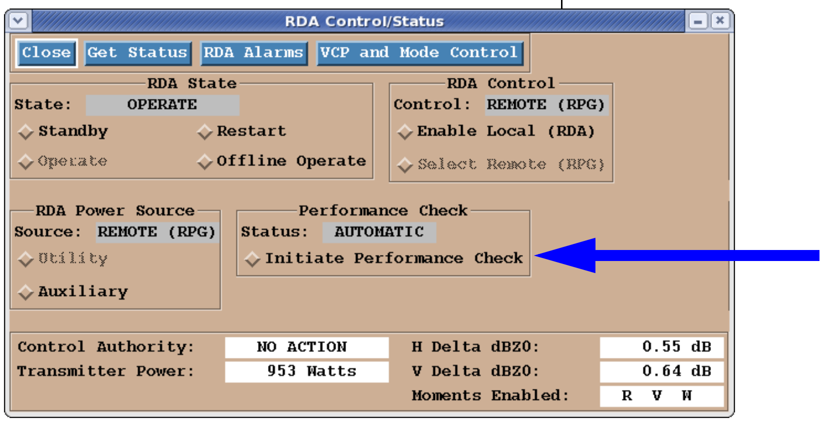


Figure 16. RDA Control window with the option to initiate the 8 Hour Performance Check.

Note: Proceed with caution while interacting with the RDA Control/Status window. For example, you would not want to accidentally Restart the RDA!!!

Improved Calibration Information

With the dual-pol upgrade, both the horizontal and the vertical channels require calibration. However, the pre-Build 14.0 "Calib" information on the RPG HCI main page was only for the horizontal channel. With Build 14.0, the "Calib" for both channels is available at the RDA Control/Status window (Figure 17). These numbers are listed as Delta dBZ0 and the normal range for both is -1.5 to +1.5 dB.

Supplemental Adaptive Intra-Volume Low-Level Scan (SAILS)

The Supplemental Adaptive Intra-Volume Low-Level Scan (SAILS) feature for RDA/RPG Build 14.0 is a significant new option, available only when using VCP 12 or 212. SAILS allows VCPs 12 and 212 to behave like a TDWR, by adding a

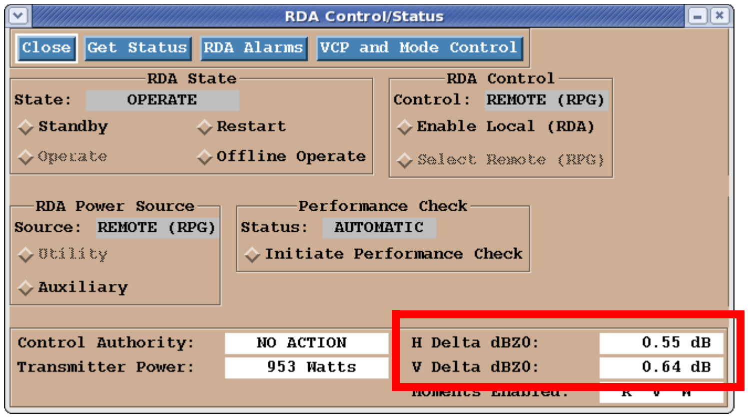


Figure 17. RDA Control window with the calibration numbers for both the H and V channels.

low level [0.5° for all sites except Langley Hill (KLGX)] scan during the volume scan.

SAILS Applied to VCP 12

To illustrate how SAILS works, Figure 18 presents the elevation sequence for VCP 12 when all of the elevations are scanned. First, elevations 0.5° through 3.1° are scanned as usual, then the antenna drops down to scan 0.5° again, after which it elevates to 4.0° and continues through 19.5° to complete the volume scan.

Even though this extra 0.5° scan, hereafter called the SAILS scan, is not in the ***physical*** middle of the elevation angles, it is in the middle with respect to ***time***. This is because, for all the VCPs, the antenna rotates slower on the lower elevation angles than it does for the upper tilts. In the case of a full VCP 12 volume scan with SAILS enabled, the 0.5° products are available at ~ 2 min, 20 sec intervals. With AVSET enabled, and the location of convection allowing for abbreviated volume scans, this timing between 0.5° products will get even shorter. The AVSET termination angle from the previous volume scan is used to define the timing of the SAILS scan for the current volume scan.

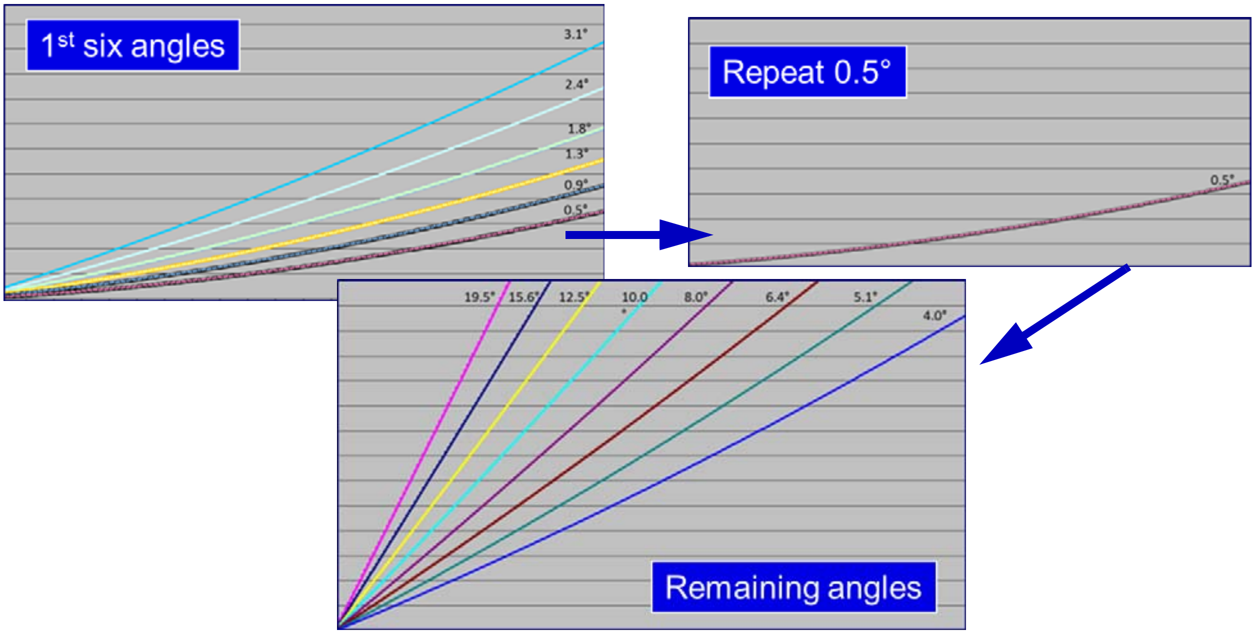


Figure 18. The SAILS process for a full volume of VCP 12.

SAILS Scan

The SAILS scan is processed as a Split Cut (just like the original 0.5° scan), with two rotations, first in Contiguous Surveillance (CS), then in Contiguous Doppler (CD). This is important for data quality, providing the greatest number of pulses for managing clutter suppression, processing super resolution data, range unfolding, and dealiasing of velocity data.

There are limitations on the availability of radar products (Level 3) and base data (Level 2) from the SAILS scan:

Products (Level 3)

The RPG will only generate ***specific*** high resolution (1.0° x .25 km) and super resolution (0.5° x .25 km) ***legacy*** base products (no dual-pol base products) from the SAILS scan:

- 8 bit Legacy Res Z and V
- 8 bit Super Res Z, V, and SW

For these SAILS scan products, the time stamp is the "start of the elevation", ***not*** the start of the volume scan. The "start of the elevation" time stamp is unique to the SAILS scan products, and allows for the appropriate sequencing of them in AWIPS.

Once adequate bandwidth between AWIPS and the Radar Product Central Collection Dissemination Service (RPCCDS) is available, dual-pol base products will also be generated from the SAILS scan data.

RPS List Adjustments

It is necessary to update the existing VCP 12 and 212 RPS lists in order to generate the SAILS scan products. In addition to the existing "All Elevs" entries for these products, also include:

- Super Res Z; levels 256; resol 0.25; elev 0.5; Cuts All
- Super Res V; levels 256; resol 0.25; elev 0.5; Cuts All
- Super Res SW; resol 0.25; elev 0.5; Cuts All

The exception to the above would be "elev 0.2" for Langley Hill (KLGX)

Base Data (Level 2)

The super res legacy base data (Z, V, and SW) and dual-pol base data (ZDR, CC and ϕ_{DP}) from the SAILS scan are included and distributed in the Level II base data stream. A Level II viewer, such as GR Analyst (Figure 19), can be used to display the dual-pol base data for the SAILS scan.

The base data from the SAILS scan are ***not*** used as input for ***any*** of the RPG algorithms. However, because of the design of many of the RPG algorithms, the presence of the SAILS scan has shown some differences in algorithm output. The ROC has prepared a summary of these differences,

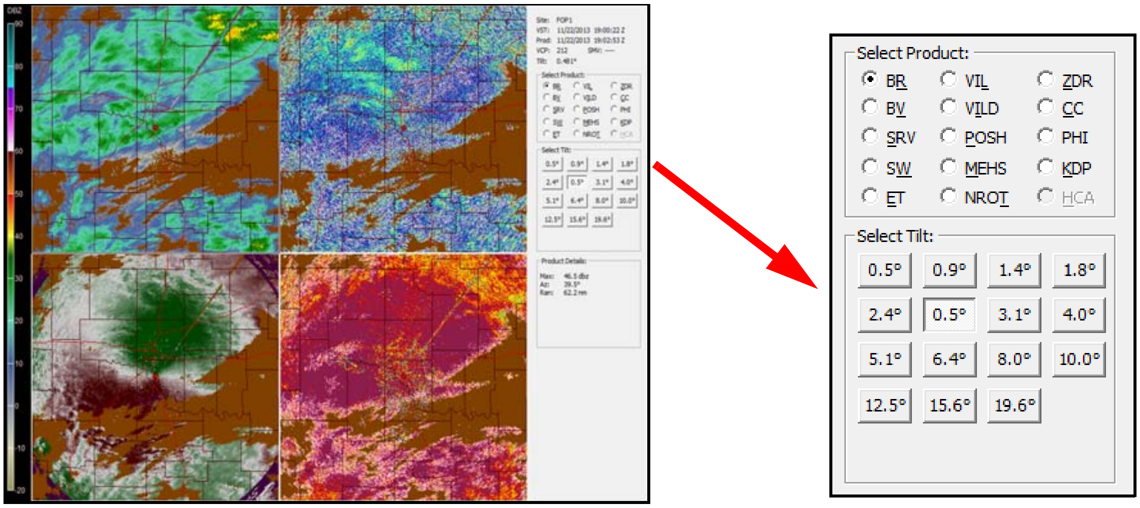


Figure 19. The SAILS scan data (including dual pol) displayed in GR Analyst.

available in the References section of the WDTB RDA/RPG Build 14.0 web site:

http://www.wdtb.noaa.gov/buildTraining/Build14

Expected SAILS Scan AWIPS-1 and AWIPS-2 Behavior

The SAILS scan is unique in that the radar products have a new time stamp. The following is the expected behavior in both AWIPS-1 and AWIPS-2 as of this writing.

- The SAILS scan will not be ingested to the Four-Dimensional Stormcell Investigator (FSI).
- In All Tilts, products from the SAILS scan are treated as a new volume scan. Moving forward or back in time at 0.5° will display the 0.5° products at the faster update rate. Once the SAILS scan products arrive, All Tilts treats these products as a new volume scan. The products from the tilts above it (with the beginning of volume scan time stamp) will not be displayed for this “new” volume scan time.
- Four panel displays are expected to update with the SAILS scan products, while the remaining products from the beginning of the volume scan remain visible. For example, for

Panel Combo Rotate, the Z and V products will update with the SAILS scan, while the beginning of the volume scan dual-pol products will remain displayed.

WES Case

WDTB has included a WES case with the deployment kits to allow NWS forecasters to practice this new behavior with the SAILS scan. A link to this WES case as a course in the NWS Learning Center is available from the WDTB RDA/RPG Build 14.0 web page:

http://www.wdtb.noaa.gov/buildTraining/Build14

SAILS and AVSET

In Figure 18, all the VCP 12 elevations are scanned, and the SAILS scan is inserted after 3.1°. When AVSET is enabled, the volume scan termination angle for VCPs 12 and 212 will change. This also changes the SAILS scan insertion angle. The lowest “insertion” for the SAILS scan is between 1.8° and 2.4°, while the highest insertion is between 3.1° and 4.0° (Figure 20).

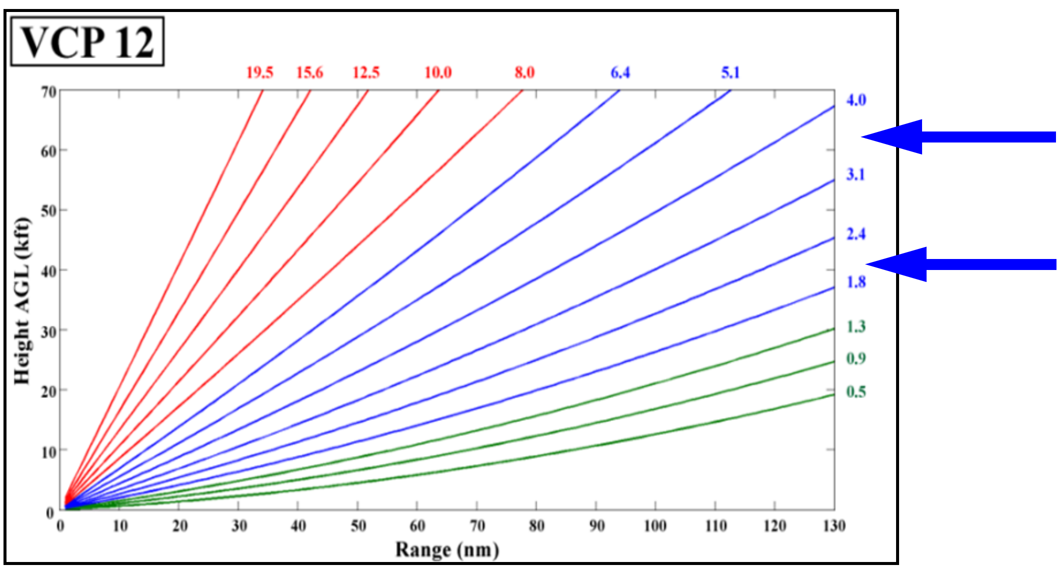


Figure 20. The range of SAILS insertion angles, depending on the VCP 12 or 212 termination angle determined by AVSET.

No Expected Impact of SAILS on WSR-88D System

ROC Engineering has analyzed the SAILS implementation to ensure there are no negative impacts on the system hardware. With SAILS, the ***largest*** elevation transition to rescan at 0.5° is 3.5°. This is well within tolerance, since angular transitions >3.5° have been in use with VCP 21 since the original WSR-88D deployment. With VCP 21, (also VCPs 221 and 121) there are two transitions aloft >3.5°, which result in the gaps in data which make VCP 21 a poor choice for convection.

Using SAILS

SAILS is an option that is limited to VCPs 12 and 212. The control/status button for SAILS is located on the RPG HCI main page, just below the AVSET control/status button (Figure 21).

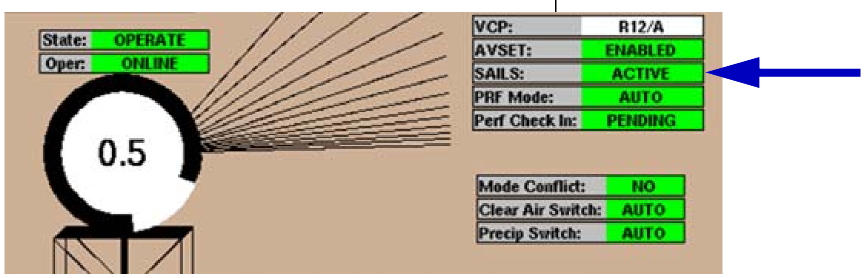


Figure 21. SAILS is enabled from the RPG HCI main page.

The SAILS function has 4 states: OFF, PENDING, ACTIVE, and INACTIVE. PENDING is an intermediate state while the system is transitioning from ACTIVE to INACTIVE or vice versa. When the SAILS button (OFF/Yellow) is selected, the button will become (PENDING/Green) until the beginning of the next volume scan. If the system is operating in VCP 12 or 212, it will then become active (ACTIVE/Green). If in any other VCP, the button will become inactive (INACTIVE/Green). SAILS will remain in the inactive state until VCP 12 or 212 is invoked manually or via the Mode Selection Function. Then, SAILS will become active (ACTIVE/Green). When the system is placed into any VCP other than 12 or 212, whether manually or via the Mode Selection Function, SAILS will again become inactive (INACTIVE/Green).

Update to AVSET

The AVSET option has been in use for several years now. Its performance has been well tested, and the results have been well received. Previously, the default setting for AVSET was disabled, meaning that enabling it required a manual command. Starting with Build 14.0, the default setting for AVSET is enabled, and it will remain enabled until it is manually disabled.

Storm-Based Auto PRF aka Auto PRF-Storm

Another major change with Build 14.0 is the implementation of Storm-Based Auto PRF, which is labeled as "Auto PRF-Storm" on the RPG HCI. This increases the options for managing the location of RF data on the velocity and spectrum width products. As the name implies, the Doppler PRF is automatically selected based on the goal of preventing specific storms from being masked by RF.

Review of Pre-Build 14.0 PRF Control Options

Two options for PRF control have existed for many years, and are preserved with Build 14.0.

1. Auto PRF selects and applies the Doppler PRF that results in the minimum RF coverage over the entire display for the lowest elevation angle. This is irrespective of ***any*** particular storm.
2. Manual PRF selection allows for a user-selected Doppler PRF for up to three different sectors of the radar coverage area.

Build 14.0 PRF Control Options

The look and feel of the PRF Control window has changed (Figure 22), with the options for PRF Control selected from the top of the window.

- "Auto PRF-Elevation" refers to the legacy "Auto PRF". The Doppler PRF that is selected is based on the minimum RF coverage over

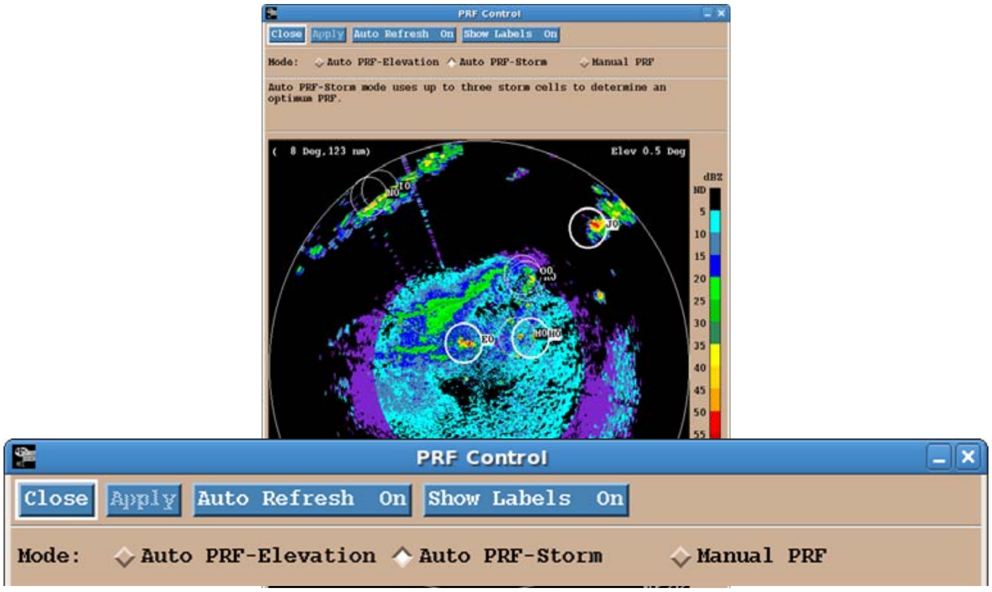


Figure 22. The PRF Control window with the three options for PRF Control at the top.

the entire lowest elevation angle, irrespective of any particular storm.

- “Auto PRF-Storm” refers to the new feature, which chooses a Doppler PRF based on storms that have been identified by the Storm Cell Identification and Tracking (SCIT) algorithm.
- “Manual PRF” refers to the familiar option of a user-selected Doppler PRF for up to three different segments of the radar coverage area.

Auto PRF-Storm (Default)

Auto PRF-Storm is the new feature of Build 14.0, and is the default setting. Auto PRF-Storm uses the top three storms, ranked by Cell-Based VIL from the SCIT algorithm, for the Doppler PRF selection, resulting in the smallest area of RF data for those storms. The top ten storm IDs and their attributes are presented on a table at the base of the PRF Control window (Figure 23). The IDs also appear as labels on the storms on the graphical area of the PRF Control window.

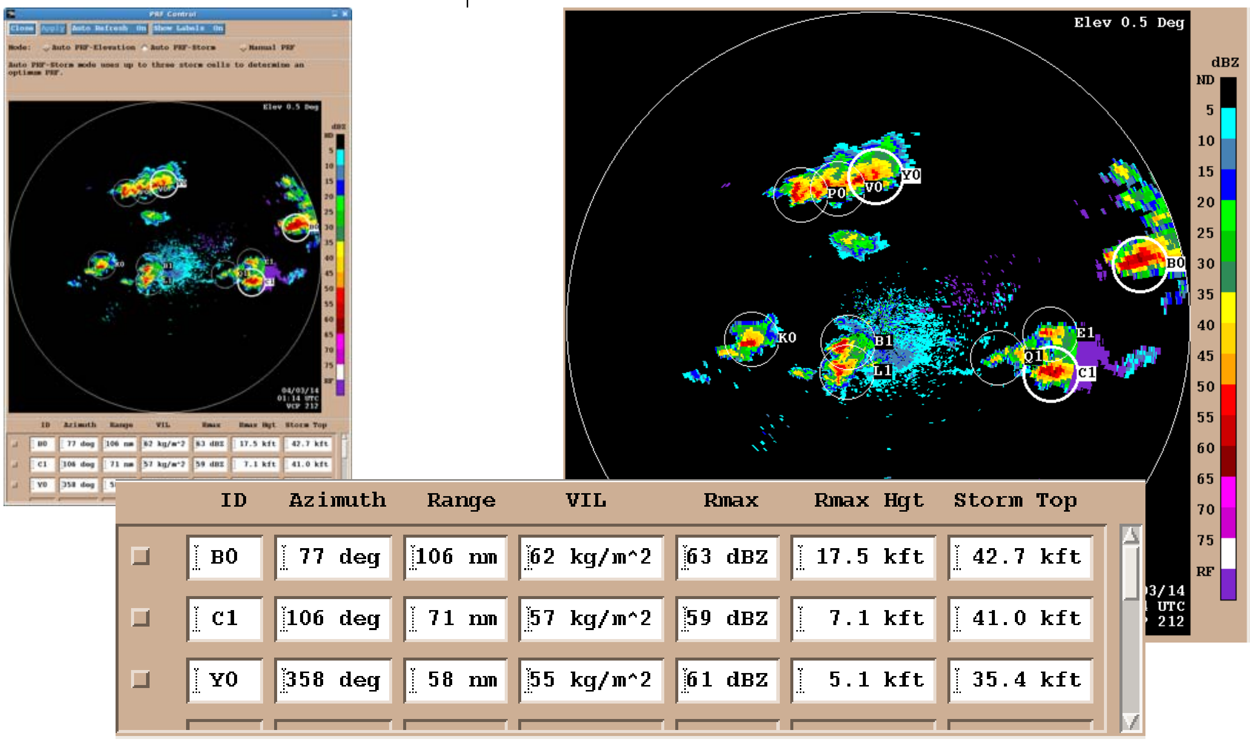


Figure 23. Auto PRF-Storm has been selected at the PRF Control window. The top 3 SCIT storms (from Cell-Based VIL) are listed at the bottom of the window.

Note: Storms must have a VIL of at least 20 kg/mg*2 to be considered by Auto PRF-Storm.

Using the SCIT algorithm projected positions for the next volume scan for each “tracked” storm, a 20 km radius “storm circle” is calculated. The number of 1 km bins with RF data within these circles for each Doppler PRF is estimated, and the PRF with the lowest number of RF bins is inserted into the current VCP, downloaded to the RDA, and implemented for the next volume scan. This sequence of events is repeated each volume scan.

When all storms dissipate, the RPG will use Auto PRF-Elevation until new storms form. The RPG

HCI will still say MULTI-STORM, since Auto PRF-Storm is “looking for” storms to develop.

Auto PRF-Storm (Single Storm)

Though using the top three storms is the default setting for Auto PRF-Storm, a single storm can be chosen as an option. The single storm selection is made by clicking on the small box to the left of the storm cell ID on the table at the bottom of the PRF Control window (Figure 24).

The process for a single storm PRF selection is the same as for the top three storms. A circle with a 20 km radius from the SCIT forecasted position is defined. The Doppler PRF that results in the least RF data within this circled area is then determined. That PRF is inserted into the current VCP, and downloaded to the RDA for the next volume scan.

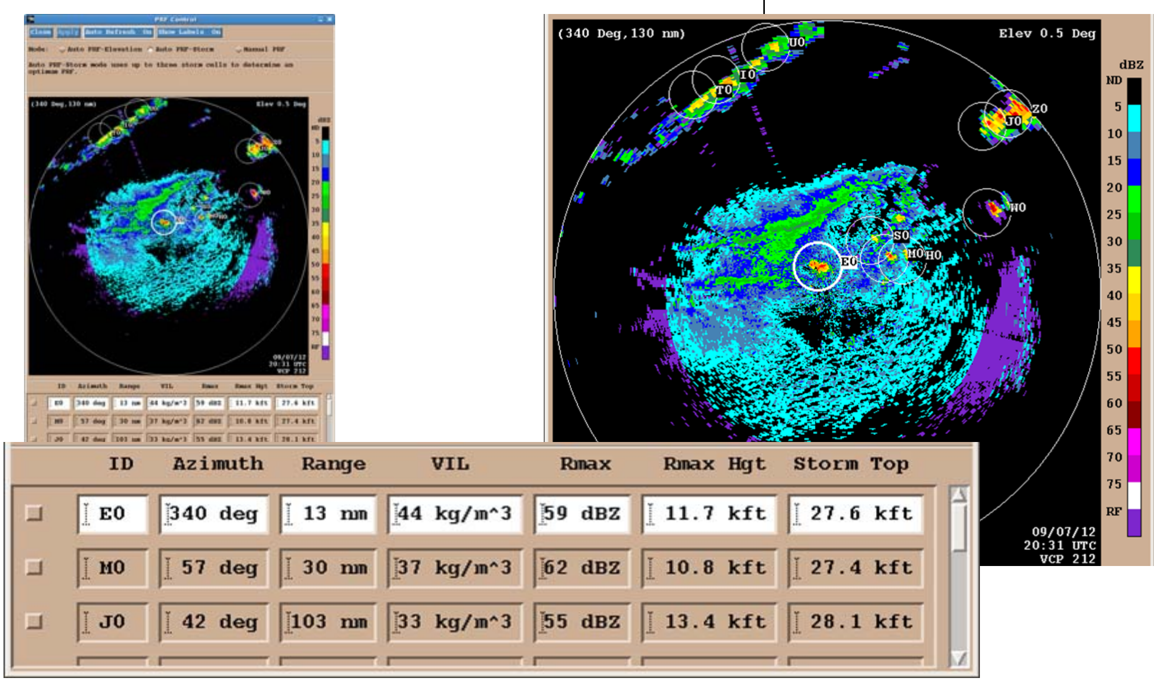


Figure 24. Auto PRF-Storm for a single storm.

The Auto PRF-Storm (Single Storm) option tracks the selected storm until that storm dissipates, is re-identified with a different Cell ID, or moves beyond

230 km. When any of these things occur, the Default Auto PRF-Storm (top three storms) will be activated. When all storms dissipate, the RPG will use Auto PRF-Elevation until new storms form. Since Multi-Storm is the default, the RPG HCI main page will show MULTI-STORM while Auto PRF- Storm is looking for new storms.

Limitations of SCIT

Whether Auto PRF-Storm is selected for the top three storms or for a single storm, limitations of the SCIT algorithm must be kept in mind:

- SCIT performs best with isolated storms, retaining more consistent storm IDs over time
- Changing VCPs may also change the SCIT storm IDs
- Merging or splitting storms can result in changes to the SCIT storm IDs

Auto PRF-Storm Reminders

For storms at long range or storms that are just maturing, Auto PRF-Storm may appear to be slow to respond. Consider the following:

- Storms must have a VIL of at least 20 kg/m*2, and sampling at long range may lower VIL values.
- The CD PRF applied by Auto PRF-Storm for any given volume is based on SCIT projected locations from the previous volume scan.

For greater detail on the Auto-PRF Storm behavior and design, see the References section of the WDTB RDA/RPG Build 14 web page:

http://www.wdtb.noaa.gov/buildTraining/Build14

PRF Mode on RPG HCI Main Page

The PRF Mode button on the RPG HCI main page (Figure 25) will have different states, depending on the PRF control option selected.

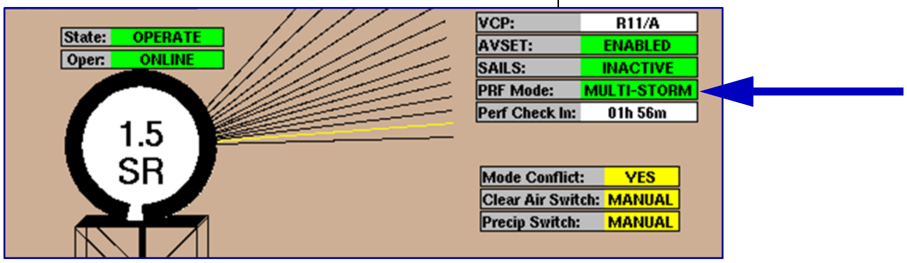


Figure 25. PRF Mode state for Auto PRF-Storm reads "MULTI-STORM"

For Auto PRF-Elevation, PRF Mode is "AUTO" with a green background

For Auto PRF-Storm (Default with 3 storms), PRF Mode is "MULTI-STORM" with a green background (Figure 25)

For Auto PRF-Storm (Single Storm), PRF Mode is "SINGLE-STORM" with a yellow background

For Manual PRF, PRF Mode is "MANUAL" with a yellow background

What Happened to the VMI?

In case you noticed that the option to edit the Velocity Measurement Increment (VMI) is no longer on the PRF Control window, it is now at the top of the VCP and Mode Control window (Figure 26). The default setting for the VMI is .97 kts, allowing for velocities with a precision of 1 kt, up to ±123 kts. When strong winds are expected, such as a landfalling hurricane, the VMI can be set to 1.94 kts, allowing for velocities with a precision of 2 kts, up to ±246 kts.

SZ-2 and PRF Control Options

The SZ-2 VCPs, 211, 212, and 221, provide a significant increase in the availability of velocity data, though with the limitation of a fixed Doppler PRF

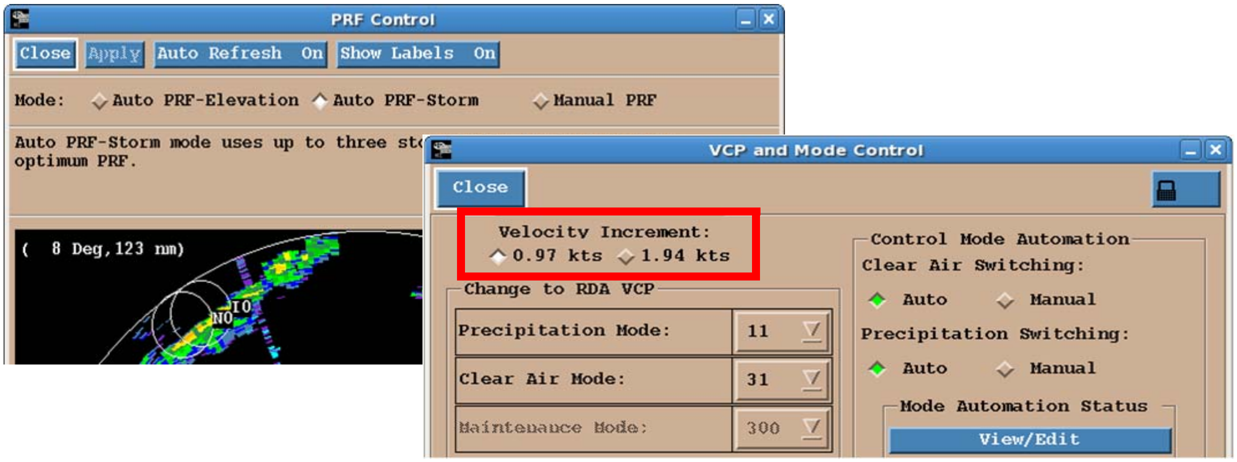


Figure 26. The option to change the VMI has been moved from the PRF Control window to the VCP and Mode Control window.

(changes previously not possible). With Build 14.0, the same PRF control options afforded all the other VCPS are available for VCP 211, 221, and 212: Auto PRF-Elevation, Auto PRF-Storm (Default), Auto PRF-Storm (Single Storm), and manual PRF selection are ***all*** available for the SZ-2 VCPs. For the PRF selected, the antenna speed is adjusted to allow for the 64 pulses per radial required by SZ-2.

Limitations of Sectorizing Doppler PRFs

SZ-2 VCPs

There is one restriction related to manual PRF selection for the SZ-2 VCPs. The RPG software will not allow for different Doppler PRFs in the three sectors for a given elevation angle. The 64 pulses per radial requirement of SZ-2 would force the antenna to speed up and slow down at the same elevation to accommodate different PRFs.

Note: None of the options for PRF Control apply to VCP 121 (or VCP 31).

Dual-Pol RPG Algorithm Adjustments

MLDA Adjustments

The Melting Layer Detection Algorithm (MLDA) relies on relatively extensive radar returns between 4° and 10° to determine the melting layer depth and height. Unfortunately, radar coverage is often not sufficient for this type of analysis for all azimuths, and the melting layer height is then based on either model data (i.e. the hourly RAP) or the height of 0°C stored at the RPG. Build 14.0 provides an approach that allows for a blend of radar and model data. It is “Model Enhanced”, and is the new default setting (Figure 27).

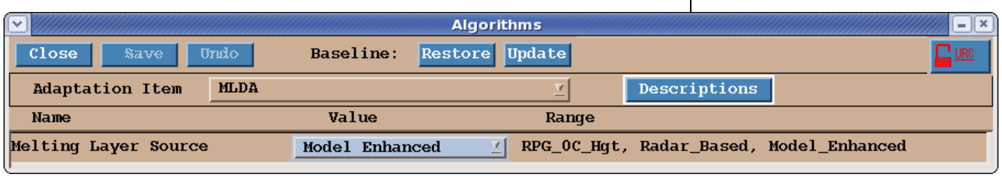


Figure 27. The new default setting for MLDA, Model Enhanced, which blends radar and model data to find a melting layer.

Model Enhanced

The Model Enhanced approach is applied radial by radial. For the azimuths where radar data have sufficient coverage, radar is used. For azimuths lacking radar data, there are two approaches:

- Gaps less than 15° are filled with an interpolation of radar-based heights from the two azimuths that border the gap.
- Gaps greater than 15° are filled using an interpolated blend from the radar-based heights at the two azimuths that border the gap ***and*** model-based heights in the area of the gap.

If no radar-based estimate can be made at ***any*** azimuth, model data will be used for the melting layer at all azimuths.

During testing, the Model Enhanced option has shown better results in identifying realistic melting layer heights with insufficient radar data. It has also shown better representation in non-homogeneous environments, such as sloping melting layers.

Radar Based

In order to use radar data exclusively for MLDA, the appropriate parameter setting is “Radar Based” (Figure 28). For sites outside of the CONUS and Puerto Rico, Model-Enhanced remains the default, even though model ingest into the RPG is not available. The Radar Based option may be required at CONUS sites if unexpected problems with model data develop.

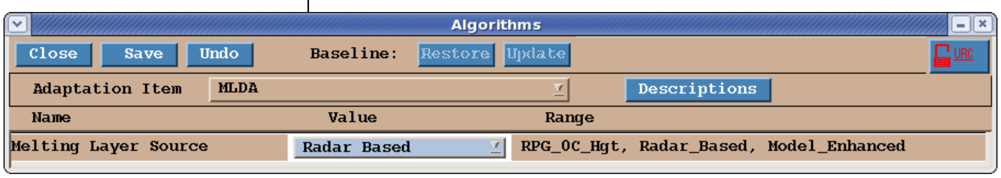


Figure 28. The Radar Based option is available if there are unexpected problems with model data.

For azimuths lacking sufficient radar data, an interpolation is made using the radar-based melting layer heights from the two azimuths that border the gap. If no radar-based estimate can be made at ***any*** azimuth, the melting layer will default to the 0°C height currently stored at the RPG as part of the Environmental Data.

RPG 0°C Height

The last parameter setting for the MLDA is “RPG 0°C Height” (Figure 29). This option assigns a 500 m thick melting layer that is constant for all azimuths, based on the 0°C height currently stored at the RPG as part of the Environmental Data. This option is not expected to be needed unless some unknown problem develops.

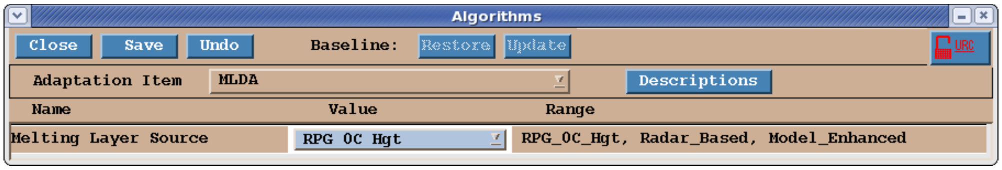


Figure 29. The RPG 0°C Hgt option applies a melting layer based on the 0°C height stored as RPG Environmental Data.

Model Data Viewer

The Model Data Viewer (Figure 30) is opened from the MISC menu at the RPG HCI. Since there are many RPG algorithms that rely on model-input data, this viewer can be used to verify that the model data are consistent with current meteorological conditions. When the Model Data Viewer is first opened, it will display the temperature field at the pressure level closest to the ground. Displayed across the top of the window are the field, pressure level, the valid date and time of the model data and the forecast hour of the model run.

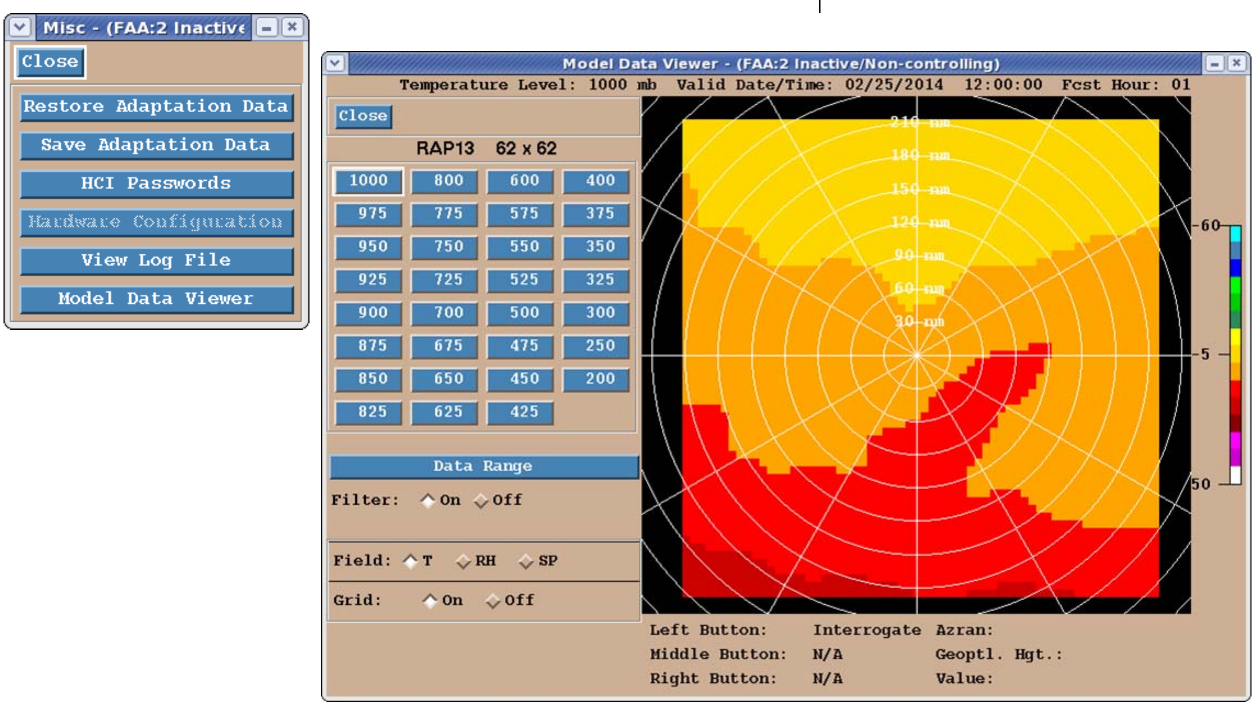


Figure 30. MISC menu at the RPG HCI and the Model Data Viewer.

QPE Adjustments

Where the Hybrid Hydroclass (HHC) product indicates Dry Snow (DS) above the top of the melting layer or Ice Crystals (IC), the rain rate used by

QPE is based on 2.8*R(Z). For long term stratiform events, especially in winter, this results in a sharp discontinuity in the rainfall estimates, with significant overestimation above the top of the melting layer. Though it is clear that 2.8 is too high for this type of event, determining a more appropriate multiplier requires local research.

URC Parameter Change

Build 14.0 introduces a parameter change that allows for editing the 2.8 multiplier for both Dry Snow and Ice Crystals based on local research. The default setting remains at 2.8, and the bounds are 1.0 to 2.8. Edits to this parameter are subject to URC guidelines and the results of local research (Figure 31).

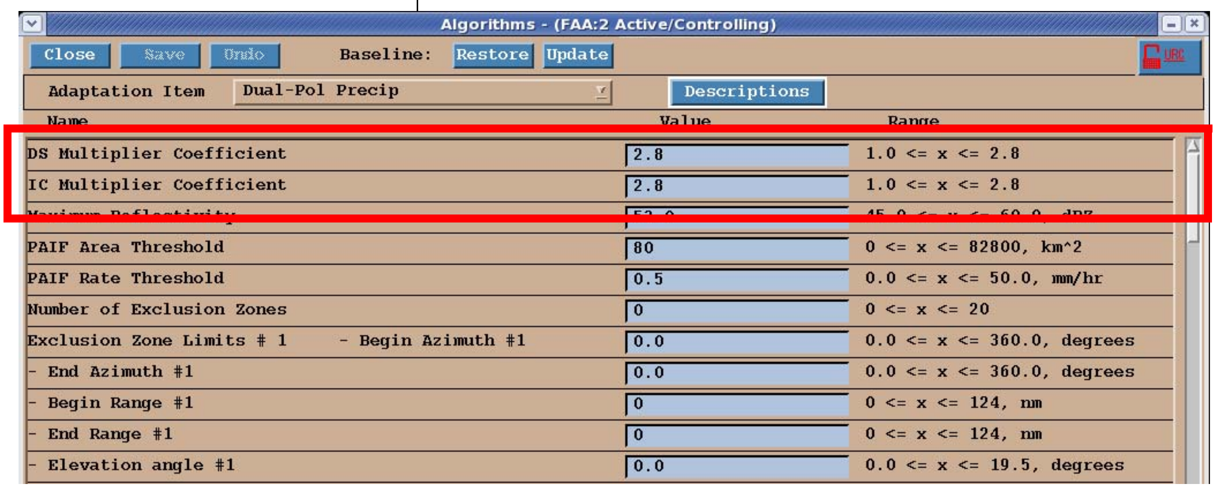


Figure 31. Dry Snow and Ice Crystal multiplier coefficient parameter editing window.

The ROC has provided guidance materials for conducting local QPE research. A link to this content (and other references) is available from the WDTB RDA/RPG Build 14.0 Training web site:

http://www.wdtb.noaa.gov/buildTraining/Build14

Eastern Region Field Test

Beginning in late 2013, six Eastern Region forecast offices are participating in a Field Test, scheduled to last about one year. Using local events and reliable gage data, these studies will determine local default values for the R(Z) multiplier. The goal is to find a better multiplier for the special case of low freezing level, widespread stratiform events. This Field Test provided the basis for the ROC guidance for conducting local research to determine a better multiplier.

Summary

This document presents the pre-Deployment Test state of knowledge of the operational impacts of RDA/RPG Build 14.0. The most significant impacts of this build are SAILS and Storm-Based Auto PRF.