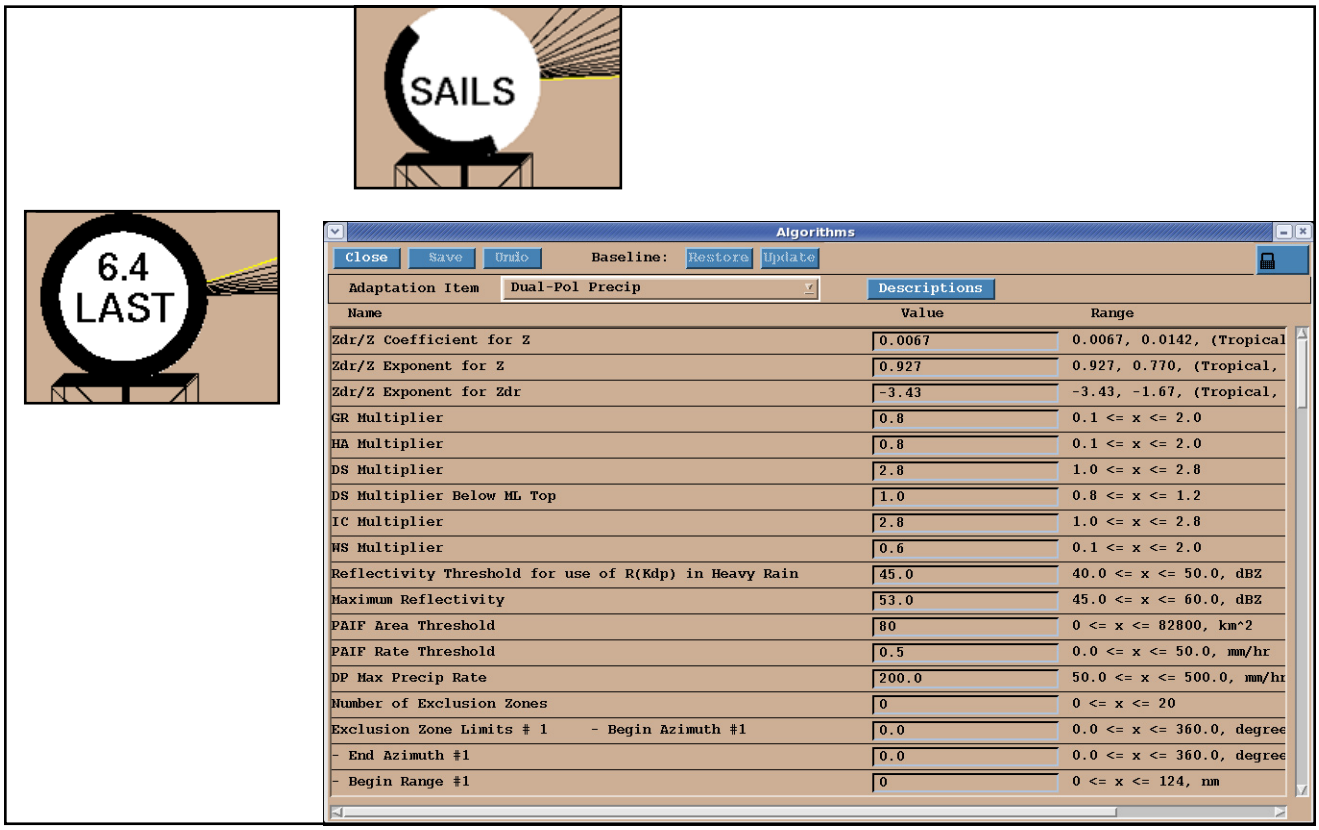
RDA/RPG Build 16.0

Training



Presented by the
Warning Decision Training Division

Version: 1506

Overview

Build 16.0 is an upgrade for both the RDA and the RPG. Though this build is primarily an RPG hardware upgrade, there are some RPG software changes that affect operations.

Unit Radar Committee

The Build 16.0 changes at the RPG may affect Unit Radar Committee (URC) decision making. Coordination among URC members with respect to how Build 16.0 impacts URC protocols is encouraged.

The information presented in this document reflects the pre-deployment state of knowledge of the operational impacts of Build 16.0.

RDA/RPG Build 16.0 Operational Impacts

The following Build 16.0 operational changes are presented in this document:

- Supplemental Adaptive Intra-Volume Low-Level Scan (SAILS) updates:
  - RPG HCI main page SAILS cut indicator
  - Dual-Pol products generated for SAILS cut
  - Multiple Elevation Scan Option (MESO) SAILS Field Test
- Last elevation on RPG HCI main page
- For Dual-Pol Quantitative Precipitation Estimation (QPE):
  - Editable multiplier for Dry Snow (DS) below the top of the melting layer
  - Reflectivity threshold for use of R(Kdp) in Heavy Rain
  - Maximum precipitation rate editable
  - Digital Accumulation Array (DAA) generated at the top of each hour
- ZDR bias estimator based on Bragg scatter
- Automated Microburst Detection Algorithm

- RPG GUI changes for sites with wideband backup service

SAILS Updates

RPG HCI Main Page SAILS Cut Indicator

SAILS is a powerful tool for use with VCPs 12 or 212 to increase the update frequency of the lowest elevation (usually 0.5°) products.

When SAILS is active for VCPs 12 or 212, it is not apparent when the SAILS cut is executed within the volume scan. With both SAILS and Automated Volume Scan Evaluation and Termination (AVSET) active, the SAILS cut is executed between different elevation angles. Build 16.0 includes a change to the RPG HCI main page to identify the SAILS elevation within a volume scan. The first 0.5° scan will continue to have the 0.5° label on the radome. When the SAILS scan is executed, “SAILS” is displayed on the radome (Figure 1).

Figure 1. First 0.5 scan (left) and SAILS scan (right) indicators on the radome at the RPG HCI.

Dual-Pol Products Generated for SAILS Cut

When SAILS was originally fielded, the products generated for the SAILS cut were limited to the legacy base data, the 8 bit Reflectivity (SDR), Velocity (SDV), and Spectrum Width (SDR), and the legacy data Array products, DR, and DV. At the time, resources were insufficient to perform the necessary testing to include the Dual-Pol products.

Build 16.0 provides default generation of the following Dual-Pol ***base*** products:

- DZD, 8 bit (256 data levels) Differential Reflectivity (ZDR)
- DCC, 8 bit (256 data levels) Correlation Coefficient (CC)
- DKD, 8 bit (256 data levels) Specific Differential Phase (KDP)

Build 16.0 provides default generation of the following Dual-Pol ***derived*** products:

- DHC, 8 bit (256 data levels) Hydrometeor Classification (HC)
- ML, Melting Layer overlay product

In addition to these Dual-Pol products, the 8 bit legacy products from the SAILS cut will be available by request via the WAN OTR.

This increase in SAILS cut products is scheduled for inclusion to the national VCP 12 and 212 RPS lists. Check the status of the national lists before editing any local lists.

MESO-SAILS Field Test

In order to build upon the success of the implementation of SAILS, the next step in dynamic scanning is the Multiple Elevation Scan Option for SAILS, or MESO-SAILS. MESO-SAILS allows for the choice of 1, 2 or 3 SAILS cuts within a VCP 12 or 212 volume scan. When the 3 scan option is chosen, 0.5° products (legacy and Dual-Pol) will update about every 75 to 90 seconds, depending on the termination angle selected by AVSET.

Following the deployment of Build 16.0, a MESO-SAILS Field Test will be conducted for one year. The goal of the MESO-SAILS Field Test is to assess added value to the hazardous weather warning process. Radar data (level 2) and prod-

ucts (level 3) generated by the Field Test sites will be available through the same distribution channels as all routine data/products. Thus the legacy and Dual-Pol products from multiple SAILS cuts will be distributed for the participating sites:

- Oklahoma City, OK (KTLX)
- Tulsa, OK (KINX)
- El Paso, TX (KEPZ)
- Dodge City, KS (KDDC)
- Wichita, KS (KICT)
- Goodland, KS (KGLD)
- Raleigh, NC (KRAX)
- Cleveland, OH (KCLE)
- Albany, NY (KENX)
- Charleston, WV (KRLX)
- Morehead City, NC (KMHX)
- Glasgow, MT (KGGW)
- Phoenix, AZ (KIWA)

SAILS Control Window

In anticipation of the MESO-SAILS Field Test, the SAILS button on the RPG HCI main page has changed. In addition to indicating whether SAILS is ACTIVE or INACTIVE, the button indicates the number of SAILS cuts within the volume scan (Figure 2). For the non-Field Test sites, the button will show ACTIVE/1 while in VCP 12 or 212.

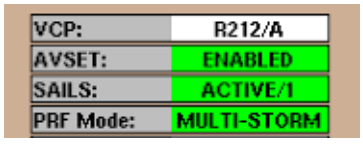


Figure 2. SAILS button indicated ACTIVE with the number of SAILS cuts (1) or INACTIVE.

Clicking on the SAILS button reveals the SAILS Control window, which allows for the selection of the number of SAILS cuts within a volume scan.

Selecting 0 cuts is the same as disabling SAILS. When MESO-SAILS is allowed, such as for the Field Test sites, this window will include selections for up to 3 SAILS cuts (0, 1, 2, or 3). This SAILS Control window was included with Build 16.0 to support the MESO-SAILS Field Test (Figure 3).

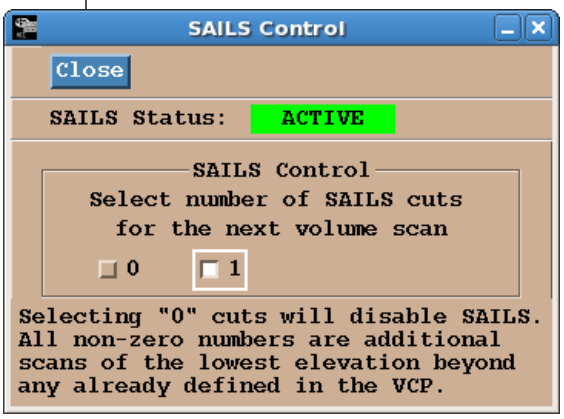


Figure 3. SAILS Control window, with the option of 0 or 1 SAILS cuts within a volume scan.

Last Elevation on RPG HCI Main Page

The use of the Automated Volume Scan Evaluation and Termination (AVSET) feature motivated a need to determine when the current volume scan will end. With Build 16.0, the radome on the RPG HCI main page will display LAST when the final elevation angle for the current volume scan is being sampled, whether AVSET is active or not (Figure 4).

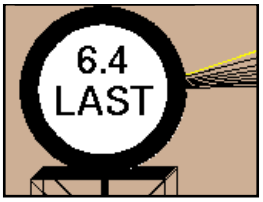


Figure 4. LAST on the radome used to indicate the final elevation.

Dual-Pol QPE Updates

Editable Multiplier for DS Below Top of Melting Layer

Dry Snow (DS), as identified by the Hydrometeor Classification Algorithm (HCA), is one of the hydroclass values used by the QPE with differing

multipliers [x*R(Z)]. The multiplier used is dependent on the hydroclass value and the location of the range bin with respect to the melting layer [as identified by the Melting Layer Detection Algorithm (MLDA)]. For the case where DS is identified below the top of the melting layer, R(Z) is used with a default multiplier of 1. Build 16.0 allows for editing of this multiplier, based on guidance from the ROC (Figure 5).

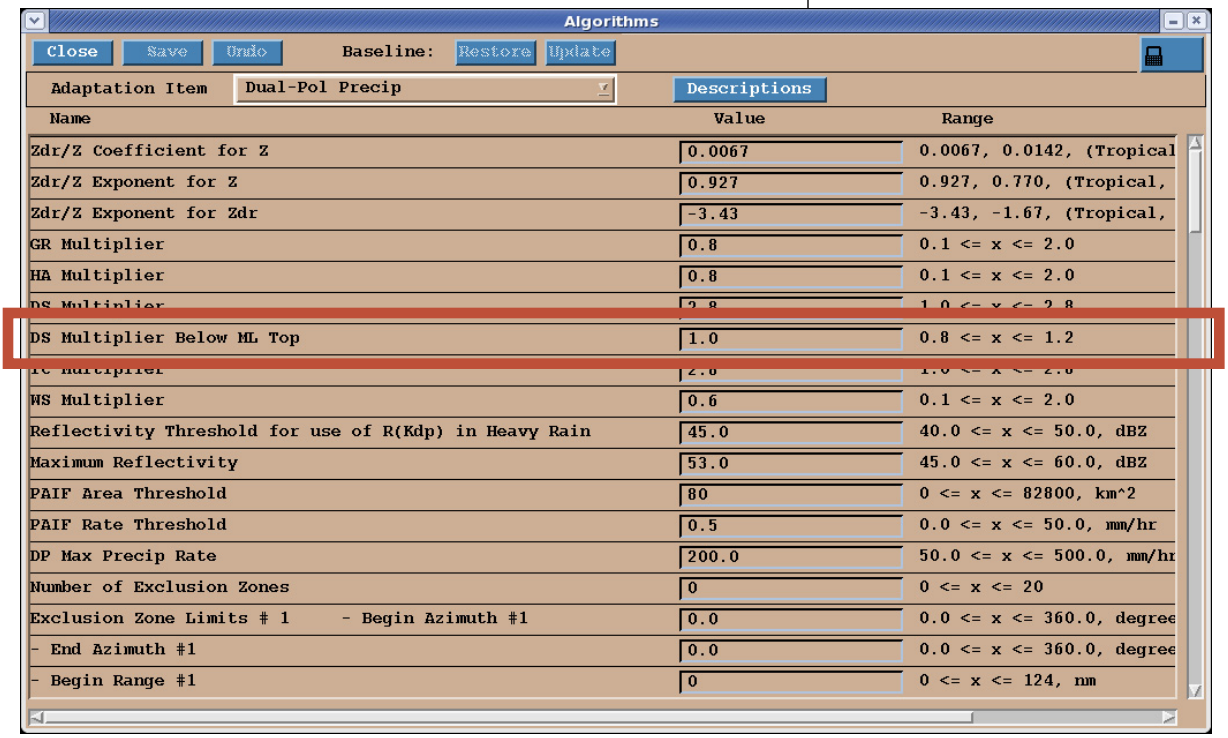


Figure 5. Dual-Pol Precip Algorithms window with the “DS Multiplier Below ML Top” highlighted.

Guidance for R(Z) Multipliers

There are now several multipliers for R(Z) on the Dual-Pol Precip parameters window that are editable. The ***only*** ones from this group that should be edited based on local research are the 2.8*R(Z) for:

- DS above the top of the melting layer, and
- Ice Crystals (IC).

The remaining multipliers are in place for research that is underway. ROC guidance with respect to

editing these other multipliers will be provided in the future.

DS and IC Multipliers

Many offices have done the necessary local research to edit the 2.8 multiplier, since it results in an overestimation above the melting layer for cold season events. There is an option with the National Severe Storms Laboratory (NSSL) Multi-Radar Multi-Sensor System (MRMS) to observe the parameter settings for IC and other hydroclass values used by QPE. This particular MRMS page presents a snapshot of the progress that has been made thus far with adjusting the IC multiplier based on local research (Figure 6).

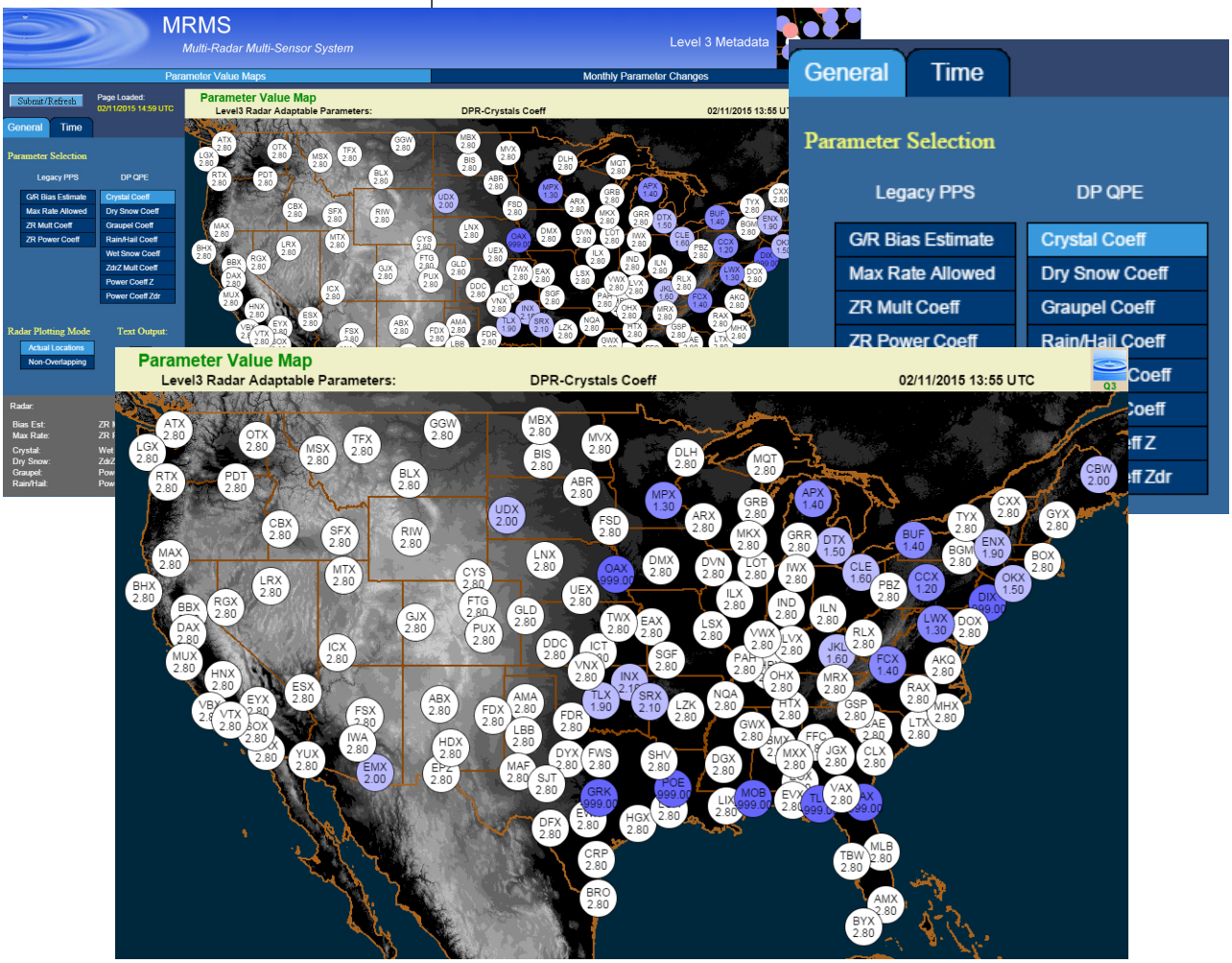


Figure 6. MRMS page with QPE and PPS metadata, specifically IC multiplier status.

The address for this MRMS page is:
http://nmq.ou.edu/applications/qvs_lev3_metadata_main.html

Reflectivity Threshold for Use of R(Kdp) in Heavy Rain

Research has shown that the R(Kdp) equation used by QPE for computing rain rates and thus accumulations performs well for heavy rain events. The pre-Build 16.0 version of QPE limits the use of R(Kdp) to the classification of Hail, mixed with Rain (HA) below the top of the melting layer. Build 16.0 allows for R(Kdp) to be used, instead of R(Z,ZDR), for Heavy Rain (HR), based on reflectivity. This is controlled by the parameter “Reflectivity Threshold for use of R(Kdp) in Heavy Rain”. The default setting is 45 dBZ, with a selection range of 40 to 50 dBZ. As of this writing, the ROC guidance for this parameter is to use the default value (Figure 7).

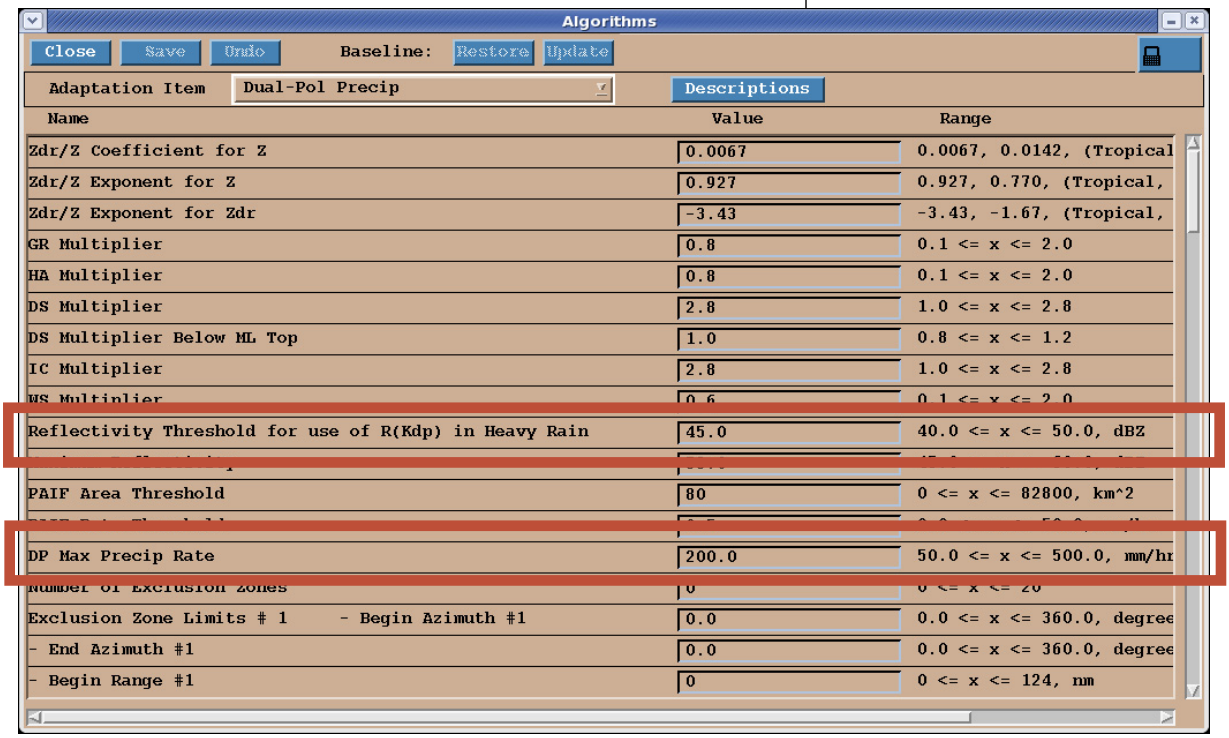


Figure 7. Dual-Pol Precip Algorithms window with Reflectivity Threshold for use of R(Kdp) and the editable Maximum Precipitation Rate.

QPE Maximum Precip Rate Editable

Both the legacy Precipitation Processing System (PPS) and the Dual-Pol QPE have parameters that limit the maximum rainfall rate. For the PPS,

the rate has been adjustable as it also serves as a hail cap for potential hail contamination. For the QPE, the maximum rainfall rate was intended to function as a climatological limit. Due to requests from field offices, this rainfall rate, “DP Max Precip Rate” is now editable with URC control. The default value is 200 mm/hr, or 7.9 in/hr (Figure 7). For contrast, the PPS maximum rainfall rate default is 103.8 mm/hr, or 4.0 in/hr.

DAA Generated at Top of Hour

A top of the hour version of the QPE’s Digital Accumulation Array (DAA) product is automatically generated. This enables compatibility with hourly rain gage data input to the Multi-sensor Precipitation Estimator (MPE).

ZDR Bias Estimator Based on Bragg Scatter

Since the deployment of Dual-Polarization, the accuracy of the ZDR base data continues to be researched. The ZDR base products are sufficient for human interpretation, where relative values (maximums, minimums) matter more than specific thresholds. The RPG Dual-Pol algorithms are more stringent, designed with the assumption that ZDR base data are accurate within ±0.1 dB. Since the WSR-88D Dual-Pol hardware design is unique, verifying this accuracy remains challenging.

Accurate ZDR base data require an understanding of the contribution from the hardware, and the ZDR bias is part of this understanding. By sampling known targets with a ZDR of 0 dB, hardware contributors can be identified. The ZDR base data calculation can then be adjusted to account for the ZDR bias. Two approaches that involve precipitation with ZDR near 0 dB (light rain and dry snow) have been implemented and continue to be used for evaluation. With Build 16.0, a new approach for estimating the ZDR bias is introduced, and it is

based on returns that are the result of Bragg scattering.

In non precipitation areas, the vertical change in temperature and moisture associated with the top of the boundary layer is often sufficient to generate Bragg scatter returns. The differing index of refraction due to these vertical changes provides returns that should have a ZDR of 0 dB, provided the beam is sampling above any ground clutter and that there is no contamination from biological targets.

The Build 16.0 ZDR Bias estimator based on Bragg scattering is part of the RPG Dual-Pol Preprocessor and computed with VCPs 32 and 21. The results of this ZDR Bias estimator will be used along with the light rain/dry snow method to continue the process of researching the accuracy of ZDR base data.

Bragg Scatter Messages on RPG Status Window

The RPG Status window has periodic messages related to the Bragg scatter ZDR Bias process, depending on atmospheric conditions. When an estimate can be made, the “ZDR Stats (Bragg)” message appears every volume scan. These messages are not intended for operational use. The information is used for engineering analysis only (Figure 8).

If there are any questions or concerns about ZDR quality for your WSR-88D, the Hotline can provide assistance as needed.

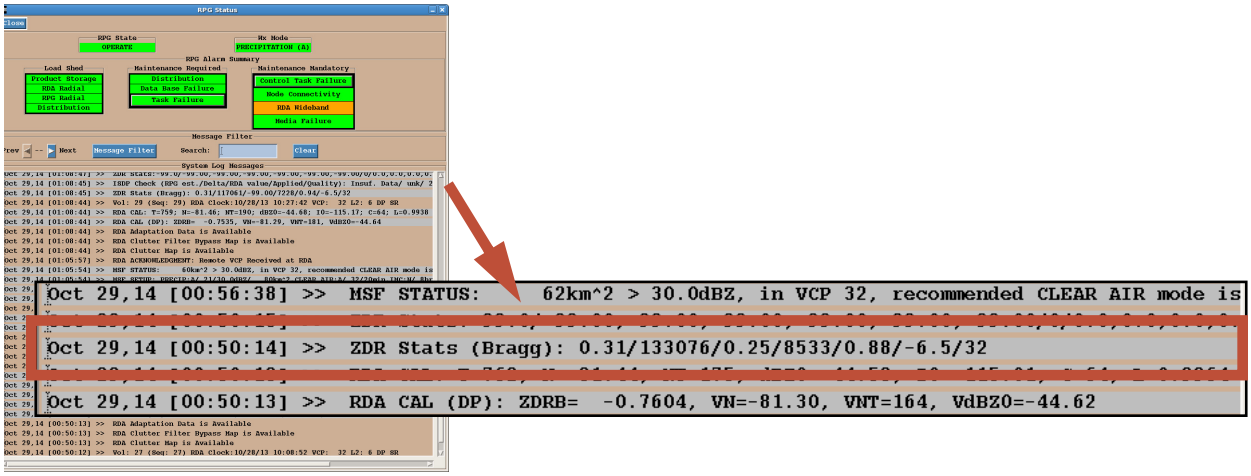


Figure 8. RPG Status window with ZDR Bias Bragg scatter message.

Automated Microburst Detection Algorithm

The Automated Microburst Detection Algorithm (AMDA) is an FAA sponsored algorithm implemented in Build 16.0.

The product generated from the AMDA is an overlay, with the mnemonic MBA. Any detections are presented as “bandaid” shaped ovals. There are different types of detections, and the categories are

- Wind Shear: deltaV ≤ 12 m/s
- Microburst: deltaV > 12 m/s and small shape size (≤ 4 km^2)
- Macroburst: deltaV > 12 m/s and shape size > 4 km^2
- Speed Shear: deltaV > 12 m/s, but wind direction does not change through the outflow, i.e. high winds exist in only one direction. This category is intended to identify moving micro/macro bursts.

There are multiple attributes for each detection:

- Strength (deltaV): The maximum deltaV within the detection area.

- Maximum Velocity (maxV): The maximum radial velocity (absolute value) within the detection area.
- Maximum shear: The maximum shear within the detection area.

An example of the MBA overlay product in the AWIPS environment is provided in Figure 9. This product will be available with AWIPS2 build 14.4.1. There is a variety of detection areas, with the cursor readout for one that meets the microburst category.

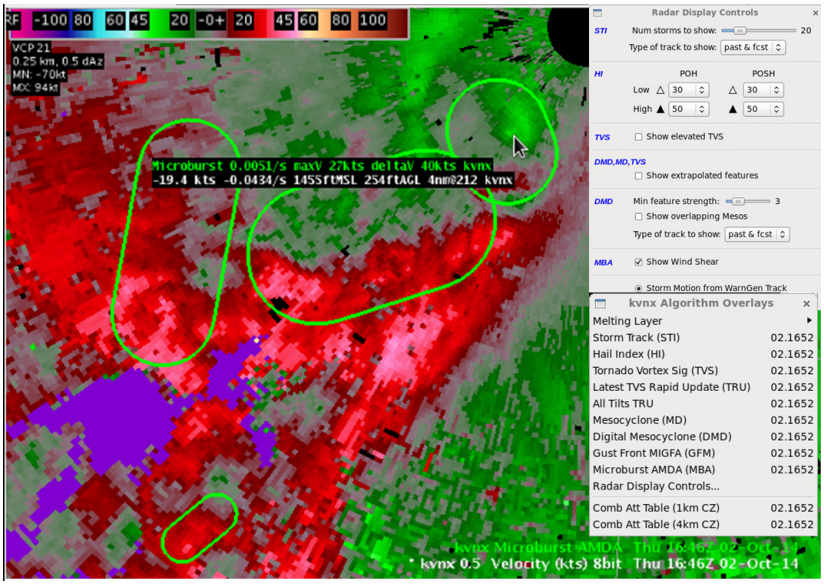


Figure 9. Automated Microburst Detection Algorithm overlay product (MBA).

RPG GUI Changes for Wideband Backup

A phased implementation of wideband backup services using 4G or Very-small-aperture terminal (VSAT) satellite began with Build 15 (deployed Fall of 2014). This backup service will eventually be available for all sites that have commercial T1 wideband links (total of 57). Build 16.0 has a new RPG Alarm to indicate when the wideband is detected to be on backup. It is a Maintenance Required alarm, labeled as RDA Wideband on the RPG Status window (Figure 10).

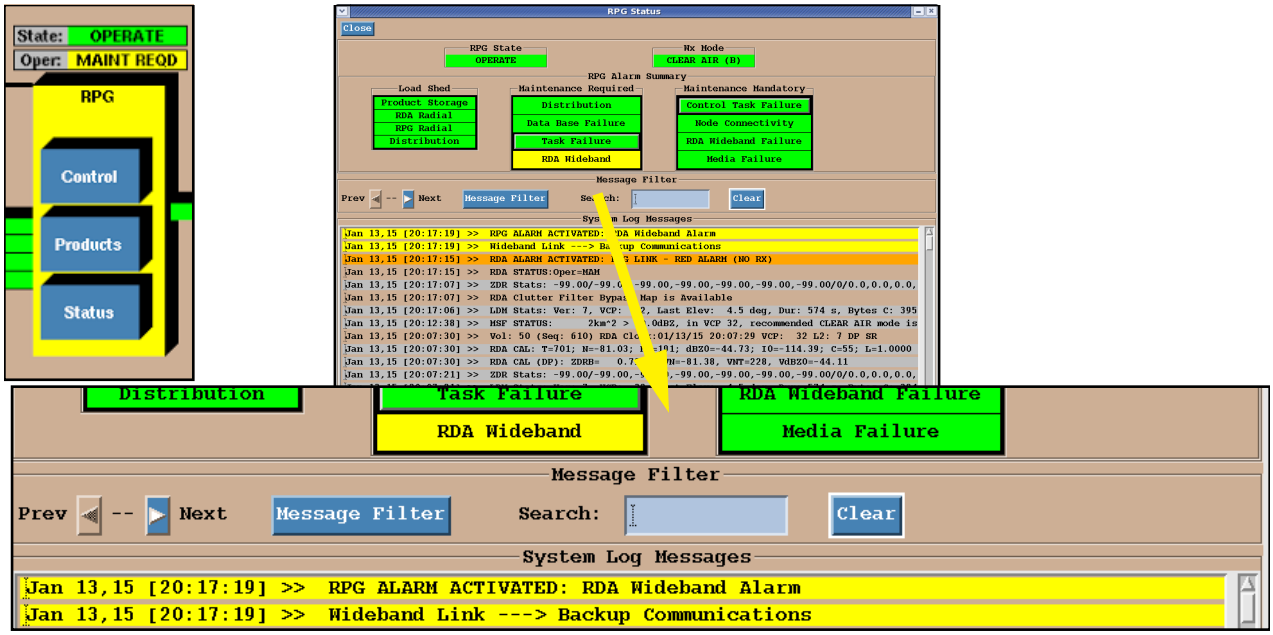


Figure 10. RPG Wideband alarm when 4G or VSAT satellite backup is used (only for sites with commercial T1 wideband communications).

Summary

This document presents the operational changes associated with RDA/RPG Build 16.0. These changes are related to SAILS, AVSET, the Dual-Pol QPE algorithm, the continued research regarding ZDR accuracy, and the implementation of the AMDA.