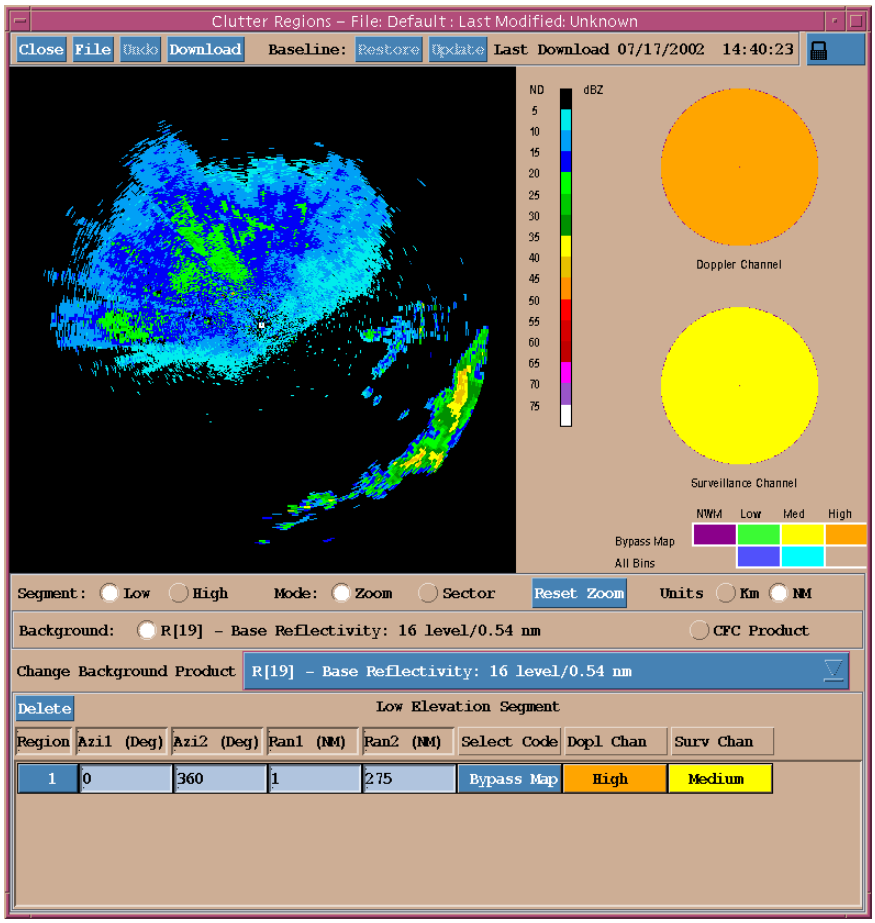
RPG Build 2 Training



Presented by the

Warning Decision Training Branch

Version: 0209

Overview

The RPG has an open system design that allows for frequent updates with respect to either hardware or software. Upcoming RPG software builds will be fielded in six month intervals. Each build will have a blend of new science, upgrades to existing products or algorithms, as well as fixes.

This document will present features of the operationally relevant changes with RPG Build 2. Some of these changes will not be apparent until AWIPS Build 5.2.2 (or later) is fielded. The best estimate of the content of upcoming AWIPS builds will be provided, based on information available at press time.

This document will focus on the following features of RPG Build 2:

1. The Radar Echo Classifier algorithm, and resultant changes to the Clutter Regions window
2. Changes to some features of the Clutter Regions window, such as password protection
3. The ability of the operator to apply a gage-radar bias value to the precipitation products. The bias value will come from the Multisensor Precipitation Estimator (MPE) Bias Table, which is calculated in AWIPS. With AWIPS Build 5.2.2, this table will be transmitted to the RPG.
4. SuperOb capability to support NCEP models
5. High Resolution VIL product
6. Improvements to window management at the RPG HCI
7. PRF Selection Window for distant MSCF configurations will use 8 data level background product

Electronic Performance Support System (EPSS)

The Electronic Performance Support System (EPSS) has been updated to support the Build 2 changes that are apparent on the RPG Human Computer Interface (HCI).

1. Radar Echo Classifier (REC)

The Radar Echo Classifier (REC) is a software package that performs fuzzy logic on the radar base data in real time. The objective of the REC is to determine the likelihood that the radar is detecting a certain category of target. For Build 2, clutter is the target category. In later builds, additional modules may be added to the REC. For example, modules for the detection of precipitation, hail, and biological targets are under development.

To determine the likelihood of clutter for any particular range bin, the REC looks at the characteristics of the reflectivity, velocity, and spectrum width base data over a small area around that range bin.

Examples of REC Analysis of the Reflectivity Field

Clutter typically has high spatial variability in the reflectivity field. The REC looks at the mean of squared differences in the reflectivity values over a small area. A large mean can indicate clutter, but could also exist due to the high gradients in convective precipitation.

An additional step looks at the average of the sign of the changes. The absolute value of the sign change of reflectivity values within an area of clutter would typically be small compared to an area with a strong reflectivity gradient.

Examples of REC Analysis of the Velocity Field

The REC also looks at the velocity data for a small area around a given range bin. The absolute value of the mean velocity can be expected to be near zero for an area of clutter.

A likelihood of the existence of clutter, expressed as a percentage, is assigned to a range bin as the result of these (and other) indications from the reflectivity, velocity, and spectrum width fields.

The REC will be generating a product called Clutter Likelihood, with two versions:

- Clutter Likelihood Doppler (CLD)
- Clutter Likelihood Reflectivity (CLR)

These two versions are available at the RPG HCI as a background product for the Clutter Regions window. Both Clutter Likelihood products are scheduled for display in AWIPS Operational Build 1. The CLD will have the color purple assigned to range folded areas in the velocity field. The CLR will not have the purple, and thus could be used to examine clutter likelihood in areas that are range folded. However, since velocity data were ***unavailable*** for these areas, the REC results should be used with caution in range folded areas.

In Figure 1, a Base Reflectivity product (16 levels, .54 nm) is displayed as a background in the Clutter Regions window. Note the area of precipitation to the southeast, with an area of anomalous propagation (AP) to the north and west.

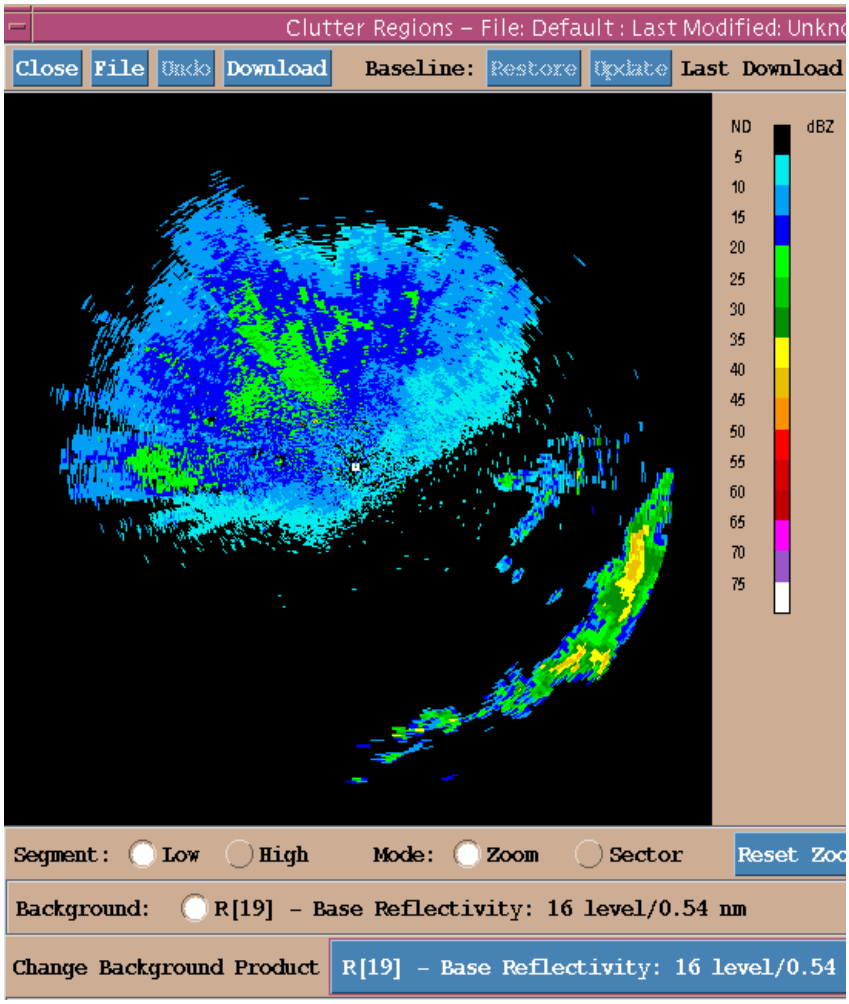


Figure 1. A Base Reflectivity product is displayed as a background in the Clutter Regions window. Note the precipitation to the southeast and AP north and west.

The Clutter Likelihood Products display the percent probability that the base data for a given range bin represent returns from clutter. The data levels are in 10% increments ranging from 0% to 90%.

In Figure 2, the Clutter Likelihood Doppler (CLD) is displayed as a background. Note the generally lower probabilities within the area of precipitation, with generally higher probabilities within the area of AP. Also note that probabilities in the range folded areas are unavailable.

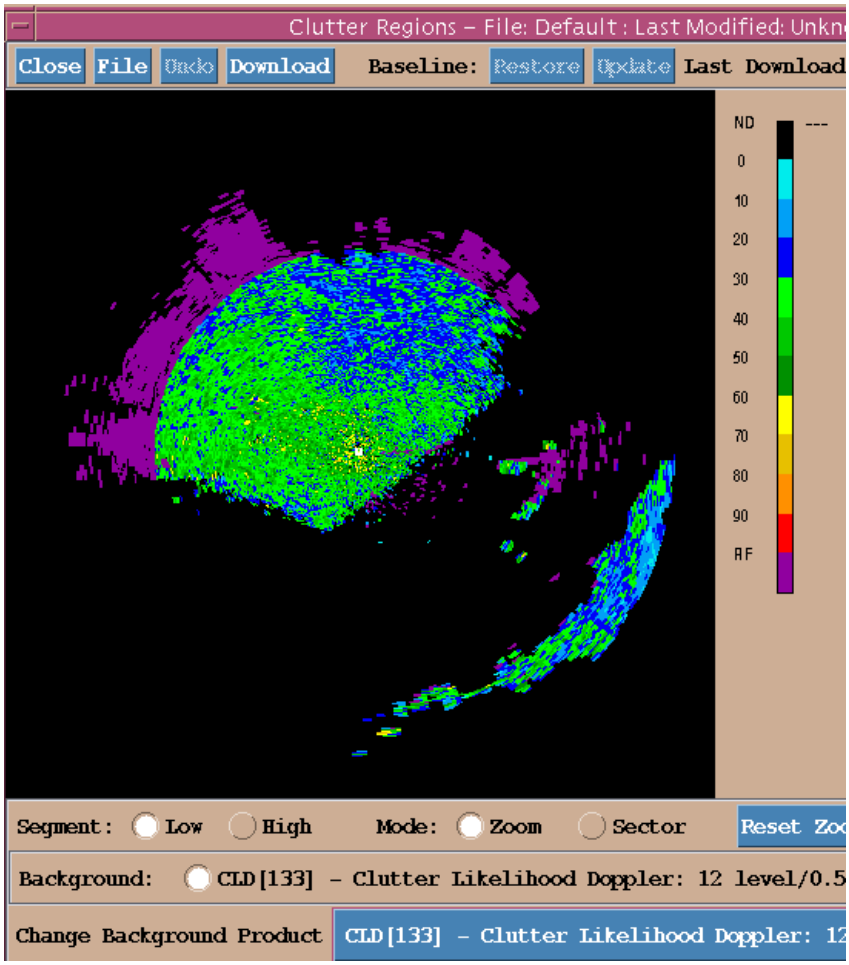


Figure 2. Clutter Likelihood Doppler (CLD) displayed as a background. Note the unavailability of probabilities in the range folded areas.

In Figure 3, the Clutter Likelihood Reflectivity (CLR) is displayed as a background. Note that probabilities from the range folded areas are available with the CLR product. However, since these values are computed by the REC using reflectivity data ***only***, they should be used with caution.

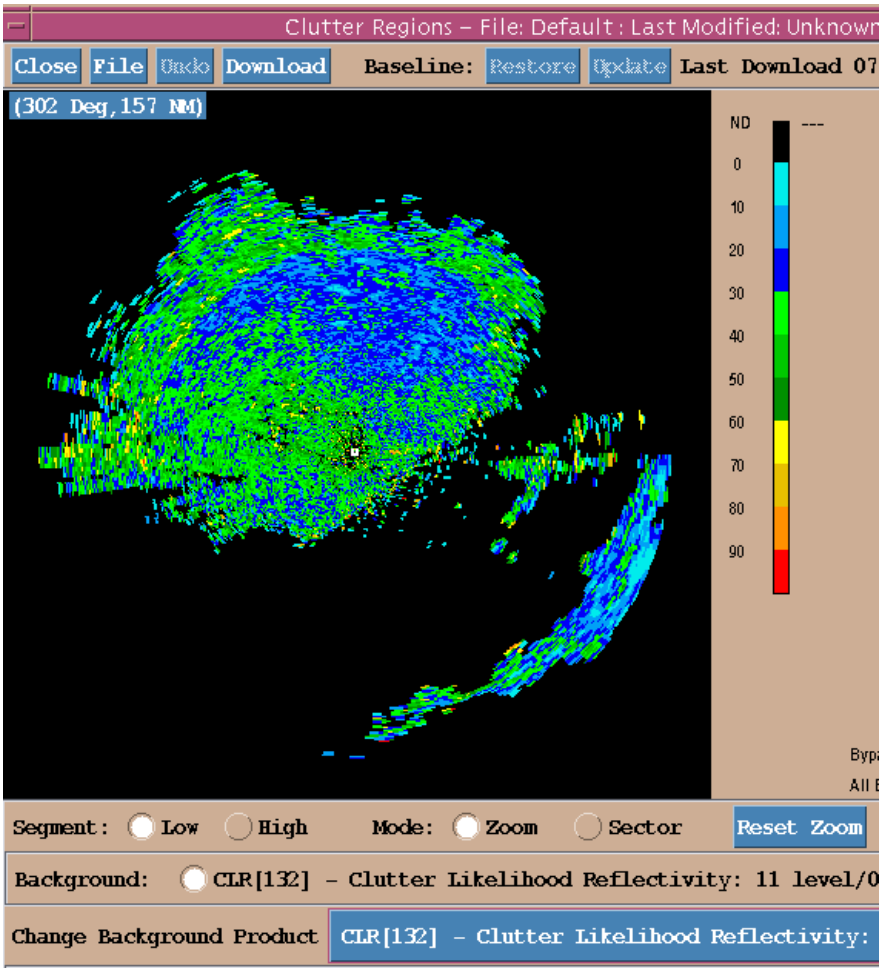


Figure 3. Clutter Likelihood Reflectivity (CLR) displayed as a background. Note generally lower probabilities within the area of precipitation and generally higher probabilities within the area of AP.

2. Changes to the Clutter Regions Window

Choice of Background Products

There are now a variety of products available for use as a background in the Clutter Regions window. See Figure 4 and Figure 5.

Figure 4. The Change Background Product dropdown menu. Note that 8 Data Level Base Reflectivity products (all three resolutions) could be selected.

Figure 5. The Change Background Product dropdown menu. Note that 16 Data Level Base Reflectivity products (all three resolutions), Clutter Likelihood Reflectivity or Clutter Likelihood Doppler could be selected.

Availability of Background Products

Product 19 (Base Reflectivity, 16 Levels, .54 nm), Clutter Likelihood Reflectivity, and Clutter Likelihood Doppler are on the default generation list. This means that these three products will be generated each volume scan and will be readily available.

The availability of the remaining products will depend on the current RPS list or any recent one time requests. If any of these products is selected as a background product and it has not been generated, the initial response will be the message “Background Product Data Not Available” (Figure 6). A request will be sent to the RPG, and the product will be generated during the next volume scan. Once available, the product will ***not*** automatically display in the window. There are three ways to display the product, once it has been generated.

1. close, then reopen the Clutter Regions window, then select the desired product
2. select a different background product, then select the original (desired) background product
3. switch from the current segment value (e.g. Low to High), then back again (High to Low)

Timeliness of Background Products

Once a background product has been displayed, it will ***not*** automatically update for subsequent vol-

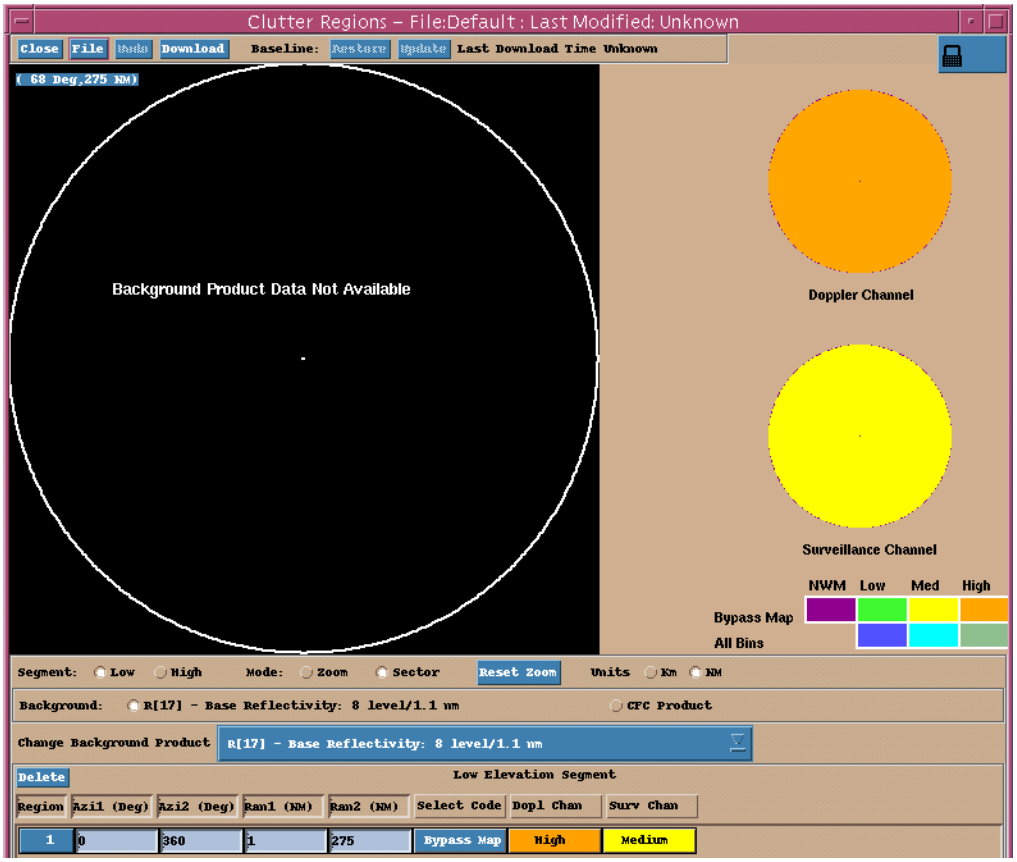


Figure 6. The Clutter Regions window when a background product that is currently unavailable has been selected. A request is sent to the RPG, and the product will be available next volume scan.

ume scans. This is even true for the products that are generated every volume scan. If you are doing a lengthy clutter editing process, or are interrupted for a period of time while editing, you may need to reselect the background product to ensure its timeliness.

Clutter Regions Window Tasks That No Longer Require a Password

The number of tasks that require a password at the Clutter Regions window has been reduced. It is no longer necessary to enter the password to edit an existing clutter regions file, to create a new file, or to download a file. In Figure 7, note that even though the padlock on the Clutter Regions window is locked, the File and Download buttons are enabled.

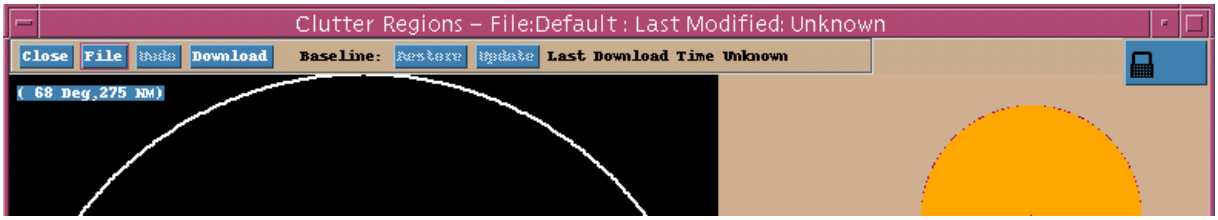


Figure 7. The Clutter Regions window when the password ***has not*** been provided. Note that the File and Download buttons are enabled.

Clutter Region Files Window Features That No Longer Require a Password

Without providing a password, the Clutter Region Files window allows you to create a new file or to display a previously defined file (See Figure 8). In either case, you may also edit the file without entering a password. This design allows for quick editing to deal with a clutter problem that is not addressed by an existing file within the Baseline Set. For a clutter problem that is addressed by an existing file within the Baseline Set, this design also allows for quickly displaying, then downloading that particular file.

Figure 8. The Clutter Region Files window when the password ***has not*** been provided.

Save or Save As

Note that the Save As button is enabled in Figure 8, while the Save button is not. This is to prevent an operator from inadvertently overwriting an existing file.

Clutter Regions Window Tasks That Still Require a Password

The buttons related to managing the Baseline Set of files are password protected. Once the password is input, these buttons are enabled. See Figure 9.

Baseline Set

The Baseline Set of files is designed to provide a group of predetermined clutter suppression

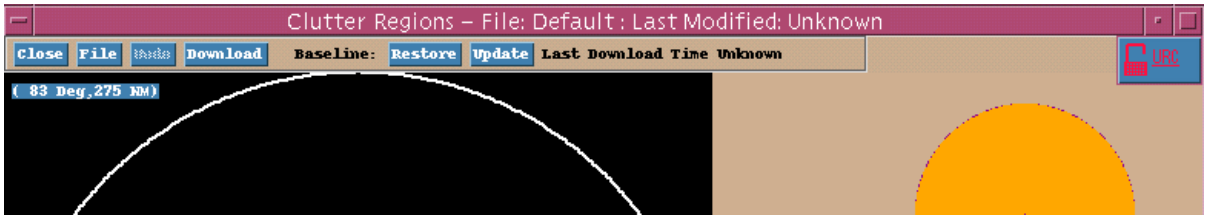


Figure 9. The Clutter Regions window when the password ***has*** been provided. Note that the Restore and Update buttons are enabled.

regions files for a variety of clutter suppression needs. Files within the baseline set should address predictable clutter problems for a particular site. For example, anomalous propagation may frequently develop in a valley due to nocturnal temperature inversions. A clutter regions file can be created to address this clutter problem and stored as part of the baseline set. The file can then be invoked as needed by selecting it from the File menu, then downloading it.

Managing the baseline set is a recommended function of the radar focal point (or some other designated person) and requires knowledge of the Update and Restore buttons. Both of these functions are now password protected, with a Unit Radar Committee (URC) Level of Change Authority (LOCA).

Update

Selecting Update will update the baseline set of files to include any newly defined and saved files.

Restore

Selecting Restore will reload the most recently updated baseline set of files. Any new file that has been defined and saved but is ***not*** yet part of the baseline set ***will be lost***.

New files that have been defined and saved are available for downloading or editing ***as long as the Restore button has not been selected***.

Clutter Region Files Window Features That Still Require a Password

When the password has been provided, there are also changes to the Clutter Region Files window. See Figure 10.

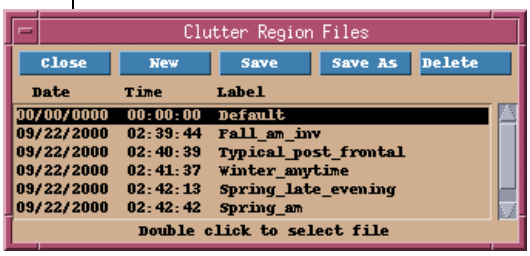


Figure 10. The Clutter Region Files window when the password ***has*** been provided.

Note that the Save and Delete buttons are now enabled (the Save button will be enabled once any change is made in the editing window). This allows for edits and adjustments to the set of existing clutter region files, i.e. the Baseline Set. Once any necessary changes are made to the files within this set, the Update button can be used to include these changes to the Baseline Set.

Final Caution

Caution is required if there is a full set of 20 files already saved. It may then be possible to overwrite one of the existing files.

The following scenario ***only*** applies to steps taken during the ***same*** editing session. In the Clutter Regions Filename window, it is typical to type a filename and then select the accept button. If the accept button is selected without first entering a filename, the file is saved using the previously entered filename. This can result in saving multiple files with the same filenames.

Changes to the Clutter Editor Legend

There is one change to the legend area on the Clutter Regions window. In Figure 11, note that the Bypass Map levels of suppression now include a

purple box that is labeled NWM (the color purple in this box has nothing to do with range folding!)

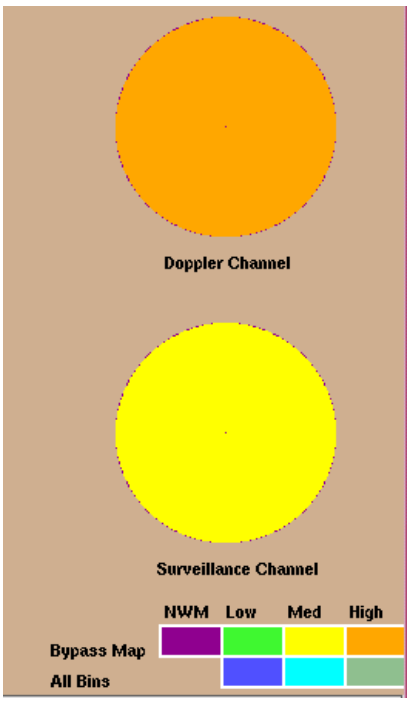


Figure 11. The Clutter Regions window legend.

Default Notch Width Map

NWM is a reference to the Default Notch Width Map. Recall that a notch width is an interval of velocities centered on zero which corresponds to a level of suppression. Any portion of the returned signal that has a velocity value that falls within the notch width will be clutter filtered. There are three different notch widths, each having a different level of suppression (low, medium, or high).

The Default Notch Width Map, is invoked when there is no operator specified clutter suppression. It applies medium suppression to the Surveillance channel and high suppression to the Doppler channel. The Bypass Map will define the geographic locations for filtering to occur, while the Default Notch Width Map defines the level of suppression.

In the Clutter Regions window, the Default Notch Width Map is invoked by deleting all the lines in the table at the bottom of the window (Figure 12).

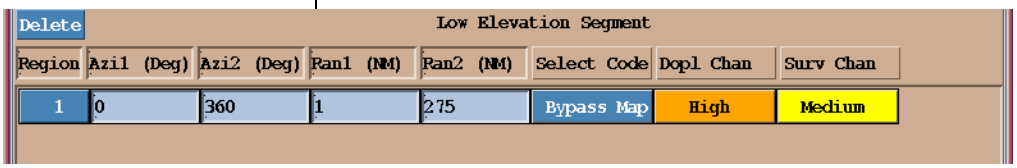


Figure 12. The table portion of the Clutter Regions Window.

This creates a file with no operator specified clutter suppression. The default clutter suppression scheme has the Bypass Map dictating the location for clutter filtering and the Default Notch Width Map dictating the level of suppression.

In the legend area of the window, the circles for the Doppler and Surveillance channels will be colored purple to denote this default condition. This “blank” file could be saved and downloaded in order to invoke this default condition.

3. Gage-Radar Bias Value

The WFO version of the AWIPS Multisensor Precipitation Estimator (MPE) function generates a Bias Table of gage-radar bias values. The fielding of AWIPS Build 5.2.2 will allow the transfer of the Bias Table to the RPG for processing.

RPG Build 2 has two significant changes to the Precipitation Processing Subsystem Adjustment Algorithm. First, all fields and logic pertinent to the legacy Bias calculator (Kalman filter) within the Adjustment Algorithm were removed. New logic was added to read the MPE generated Bias Table, and select the best bias value. The selection of the best bias is based on an adaptable parameter, “Threshold # of Gage/Radar Pairs Needed to Select Bias from Table”. The default setting for this parameter is 10.

Inspecting the Bias Value

The Bias Table information will be displayed as part of the revised Supplementary Precipitation Data (SPD) product. The best bias value will be displayed on page 1, along with fields such as the number of gage-radar pairs used to calculate the bias. The entire Bias Table will be displayed on page 2 of the SPD.

As of this writing, examples of the revised SPD at an AWIPS workstation were not yet available. There may be differences between the following examples and the final AWIPS version. See Figure 13 for an example of page 1 of the SPD with the best bias displayed. See Figure 14 for an example of page 2 of the SPD with the Bias Table displayed.

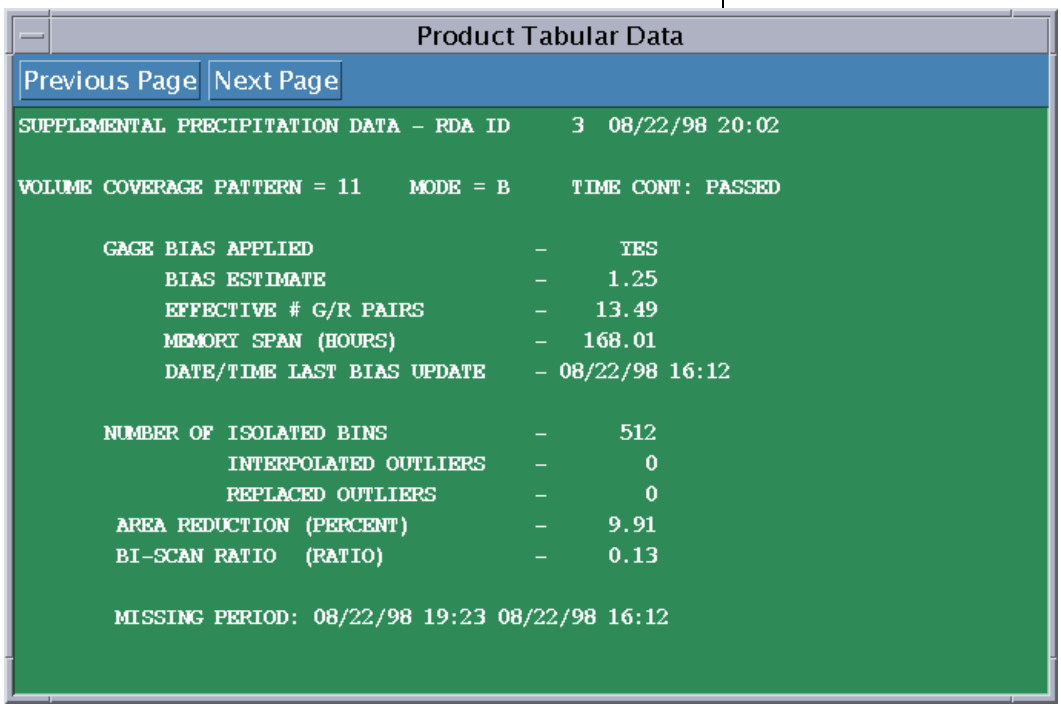


Figure 13. Supplemental Precipitation Data page 1, with best bias displayed.

Product Tabular Data

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GAGE-RADAR MEAN FIELD BIAS TABLE

LAST BIAS UPDATE TIME: 08/22/98 16:12 BIAS APPLIED ? YES

MEMORY SPAN (HOURS)	EFFECTIVE NO. G-R PAIRS	AVG. GAGE VALUE (MM)	AVG. RADAR VALUE (MM)	MEAN FIELD BIAS
0.001	0.000	1.016	1.090	0.932
1.000	0.000	1.863	1.538	1.211
2.000	0.000	2.648	1.933	1.370
3.001	0.000	2.825	2.032	1.391
4.998	0.000	2.908	2.089	1.392
10.004	0.000	2.935	2.118	1.386
168.006	13.494	2.627	2.094	1.255
719.819	126.212	2.417	2.104	1.149
2160.295	212.154	2.381	2.109	1.129
9999044.000	277.982	2.365	2.112	1.120

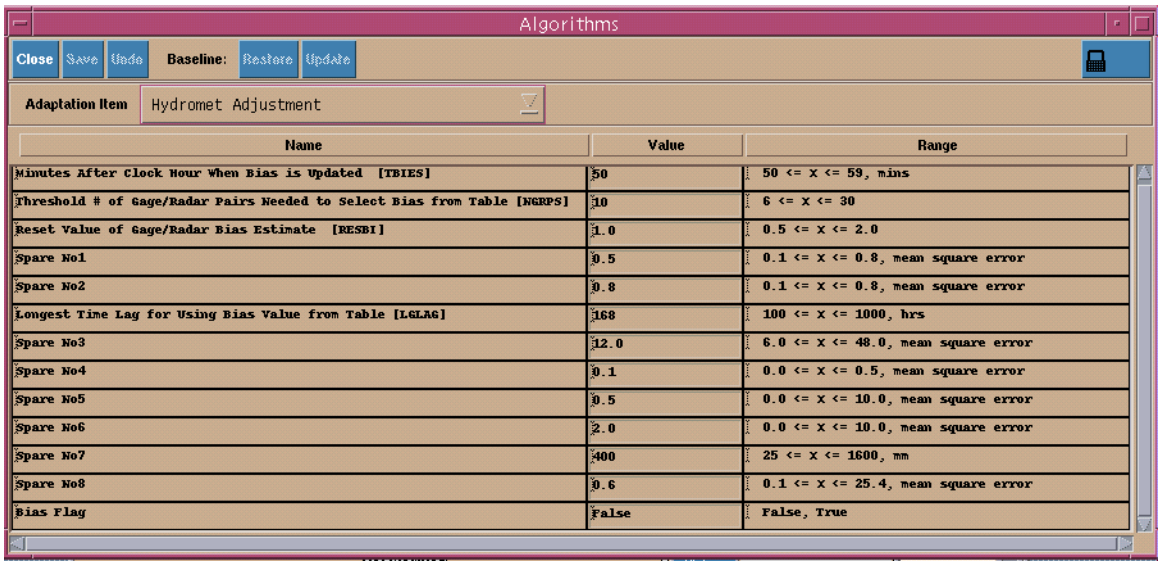
Figure 14. Supplemental Precipitation Data page 2, with the Bias Table displayed.

Applying the Bias Value

Once AWIPS Build 5.2.2 is fielded, the operator can use the SPD to determine if applying the bias is desirable. The parameter that controls the application of the bias value is called the Bias Flag, and it is located on the Hydromet Adjustment adaptable parameters window. The Bias Flag is an adaptable parameter that is under the URC LOCA. See Figure 15.

The Bias Flag parameter will typically be set to “false”, which does not apply the bias value. If a situation arises where it is desirable to apply the bias, the bias flag must be set to “true”. It will be necessary to remember to reset the bias flag to “false” once the bias adjustment is no longer needed.

If applied, the bias adjustment will affect the various precipitation products as follows.



Name	Value	Range
Minutes After Clock Hour When Bias is Updated [TBIES]	50	50 <= X <= 59, mins
Threshold # of Gage/Radar Pairs Needed to Select Bias from Table [NGRPS]	10	6 <= X <= 30
Reset Value of Gage/Radar Bias Estimate [RESBI]	1.0	0.5 <= X <= 2.0
Spare No1	0.5	0.1 <= X <= 0.8, mean square error
Spare No2	0.8	0.1 <= X <= 0.8, mean square error
Longest Time Lag for Using Bias Value from Table [LGLAG]	168	100 <= X <= 1000, hrs
Spare No3	12.0	6.0 <= X <= 48.0, mean square error
Spare No4	0.1	0.0 <= X <= 0.5, mean square error
Spare No5	0.5	0.0 <= X <= 10.0, mean square error
Spare No6	2.0	0.0 <= X <= 10.0, mean square error
Spare No7	400	25 <= X <= 1600, mm
Spare No8	0.6	0.1 <= X <= 25.4, mean square error
Bias Flag	False	False, True

Figure 15. Hydromet Adjustment Algorithm adaptable parameter window. The Bias Flag parameter controls the application of the gage-radar bias.

- OHP - The value of the bias at the end of the hour is applied (or not applied) to the entire hour's accumulations.

- THP & USP - These two products are based on hourly accumulations that end at the top of the hour. For each of the constituent hours, if the bias flag is set to "true" at the top of the hour, the bias value will be applied to the entire hour's accumulations.

- STP - The bias value is applied (or not applied) to each of the scan-to-scan accumulation periods that comprise the STP.

- DPA - The bias value is never applied. The DPA (unadjusted) is used in the MPE in AWIPS for a number of things, including determining the next Bias Table.

4. SuperOb

As part of the implementation of NCEP high resolution regional models, there is a need for radial wind observations for model initialization. Existing velocity products do not meet this need. SuperOb is a program that creates an average of radial

velocities within small azimuth-range sectors (called SuperOb cells) for each elevation angle.

The resultant SuperOb product will be generated once per hour at 30 minutes past the hour and sent to AWIPS. It is then transferred to NCEP via the AWIPS WAN.

The size of the SuperOb product will be proportional to the extent of the weather echoes. The SuperOb program also provides the necessary data compression software to minimize the amount of data to be transmitted, while maintaining data precision.

5. High Resolution VIL Product

The High Resolution VIL product is not a replacement for the existing gridded VIL product. The High Resolution VIL has a 1° by 1 km (.54 nm) polar format with 256 data levels. It has a range of 460 km (248 nm).

The development of this product was supported by the FAA, with the desire to have a product that better displays small VIL values. There is finer data resolution in the lower VIL values than the higher.

The High Resolution VIL is intended for display on the FAA Integrated Terminal Weather System (ITWS). At the time of this writing, it is not yet known when the High Resolution VIL might be displayable in AWIPS. It must first be evaluated to determine its utility for NWS operations.

Operational Applications

Applications of this product for NWS operations are unknown at this time. For example, research that applies to the gridded VIL product, such as the VIL of the day, is not valid for the High Resolution VIL, and must be evaluated at a later time.

6. Improvements to Window Management at the RPG HCI

While navigating through the RPG HCI, a single mouse click is all that is necessary to open a new window. Prior to Build 2, inadvertent multiple clicking would result in multiple copies of the same window, which was not apparent to the operator, and sometimes resulted in slower communications. Also, a window might be hidden behind several other windows. If this window is reselected, it would remain hidden and not open, which appears to the operator to be an error.

RPG Build 2 will address both of these issues. If multiple clicks are used to open a window, only one copy of the window will open. If a window has previously been opened and is in the background, when reselected it will pop to the foreground.

These changes apply ***only*** to windows within the RPG HCI.

7. PRF Selection Window for Distant MSCFs

An example of a distant MSCF configuration would be an RPG HCI in a forecast office that is linked to a DOD radar site. This type of connection results in slower communications. One change in RPG Build 2 that mitigates this problem is the background product in the PRF Selection Window. Instead of the 16 data level reflectivity data, distant MSCFs will display 8 data level reflectivity data.

Summary

This document provides an overview of the operationally relevant impacts of RPG Build 2. Some of the RPG Build 2 changes are apparent at the RPG HCI, while others will not be apparent until the fielding of AWIPS Build 5.2.2, or later.