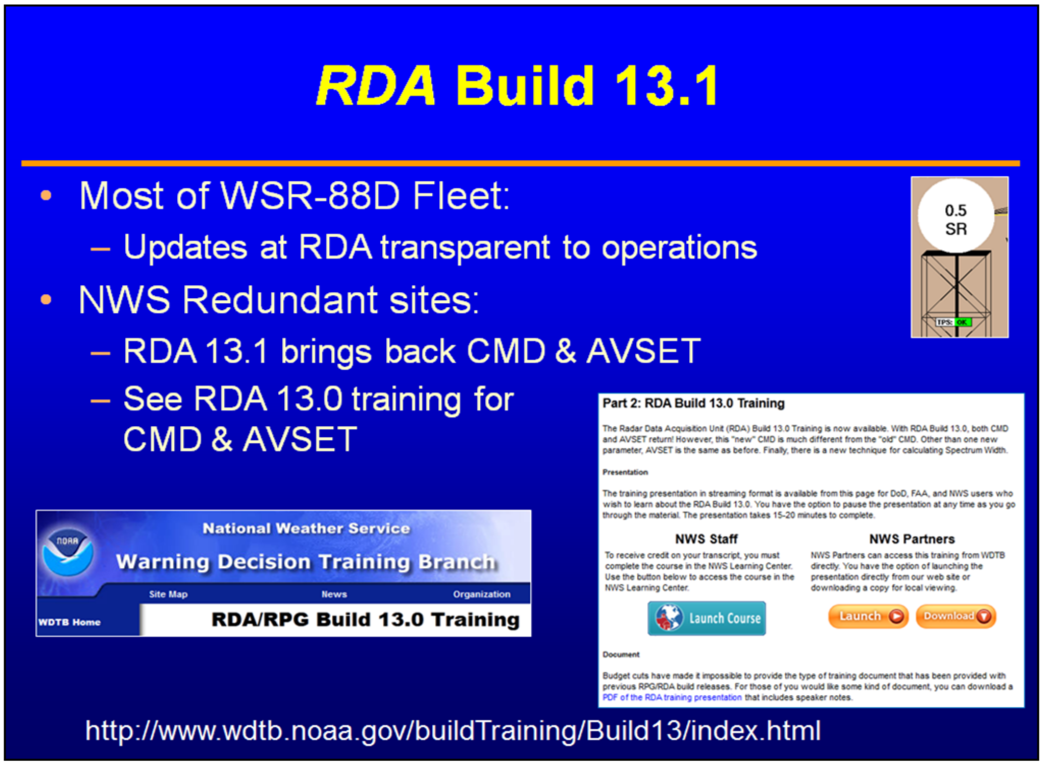
Welcome to the RDA/RPG Build 13.1 operator training.

RDA/RPG Build 13.1 & Dual-Pol

- Got Dual-Pol?
  - RDA/RPG Build 13.1 installed Jan-Feb 2013
- No Dual-Pol yet?
  - RDA/RPG Build 13.1 installed ~4 weeks after Dual-Pol upgrade

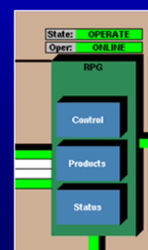
The Dual-polarization deployment for the WSR-88D fleet is ongoing. The effects and timing of RDA/RPG Build 13.1 will depend on whether or not your radar has been upgraded. For those sites already upgraded to Dual-Pol, RDA/RPG Build 13.1 will be installed beginning in mid January 2013. For those sites receiving Dual-Pol during 2013, RDA/RPG Build 13.1 will be installed about 4 weeks following the Dual-Pol upgrade.



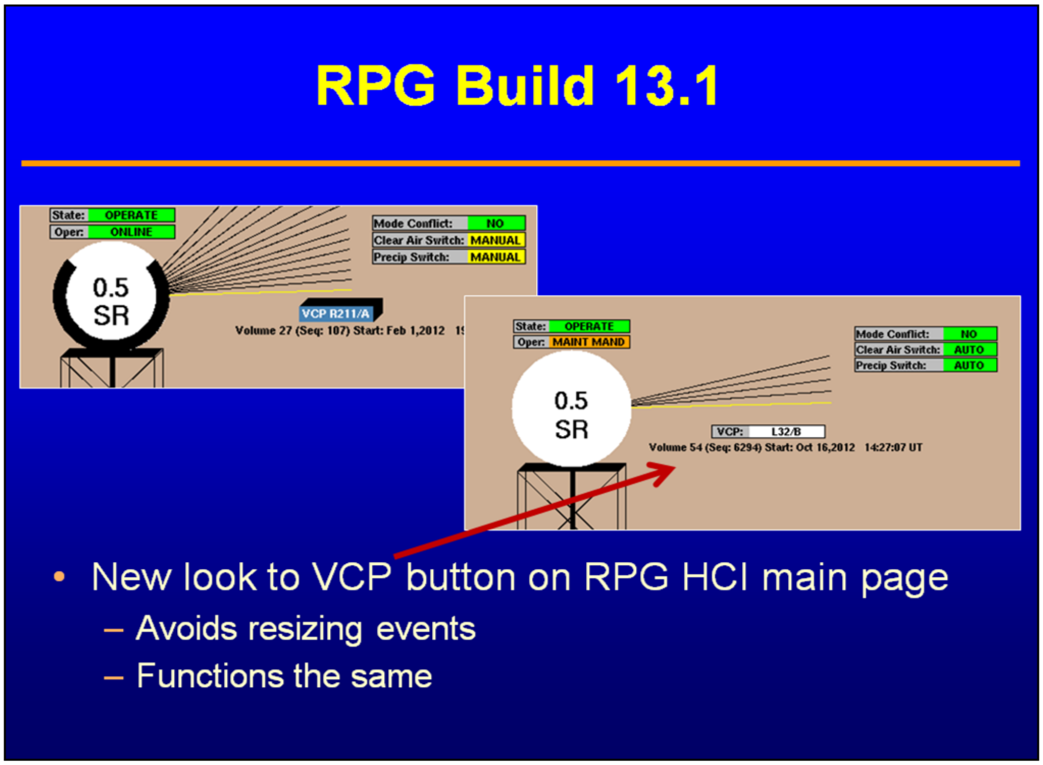
The RDA portion of Build 13.1 has changes that are transparent to the majority of WSR-88D sites on the network. The exceptions are the NWS Redundant sites, which did not get CMD & AVSET restored following their Dual-Pol upgrade. These sites will need RDA Build 13.1 to see CMD & AVSET again. The training for the return of CMD & AVSET was part of RDA Build 13.0 and is available from the WDTB web site on this slide.

RPG Build 13.1

- Independent of DP:
  - New look to VCP button
  - 2D Velocity Dealiasing Algorithm (2D-VDA)
- Relevant only if you have DP
  - QPE difference products
  - Dual-Pol QPE blockage threshold changes

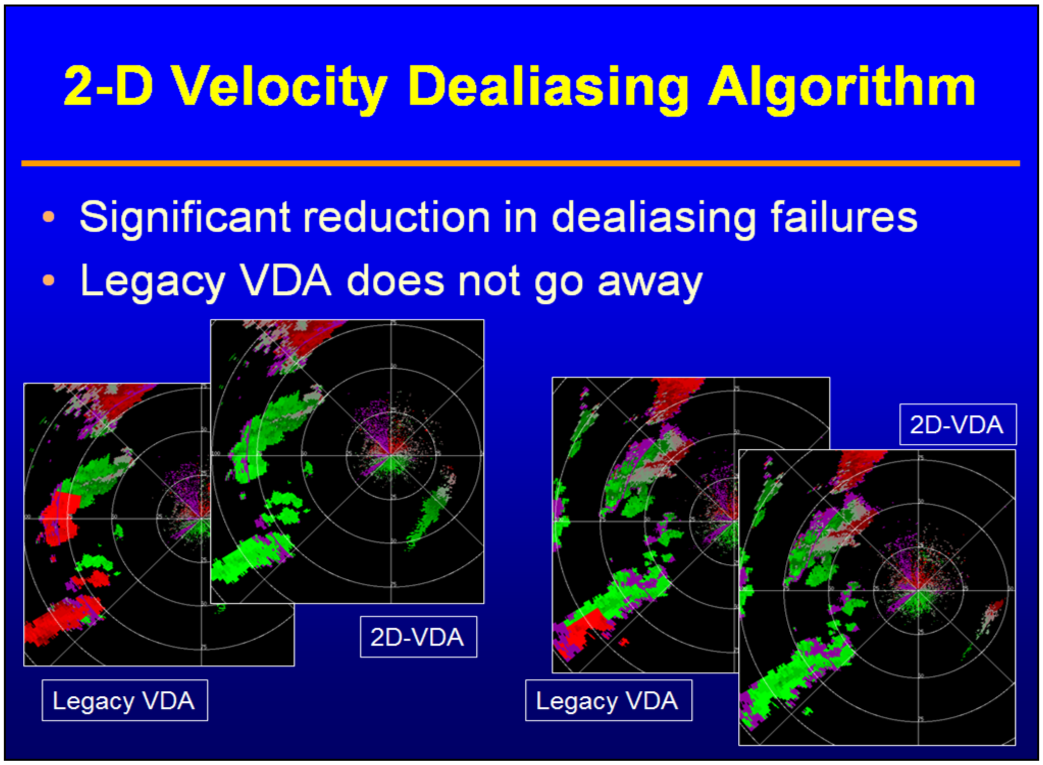


There are two RPG Build 13.1 features that are independent of the Dual-Pol RPG algorithms. The first is a new look to the VCP button on the RPG HCI main page. The second, and more significant, is called the Two Dimensional Velocity Dealiasing Algorithm (2D-VDA). The remaining changes with RPG Build 13.1 are related to the Dual-Pol RPG algorithms.



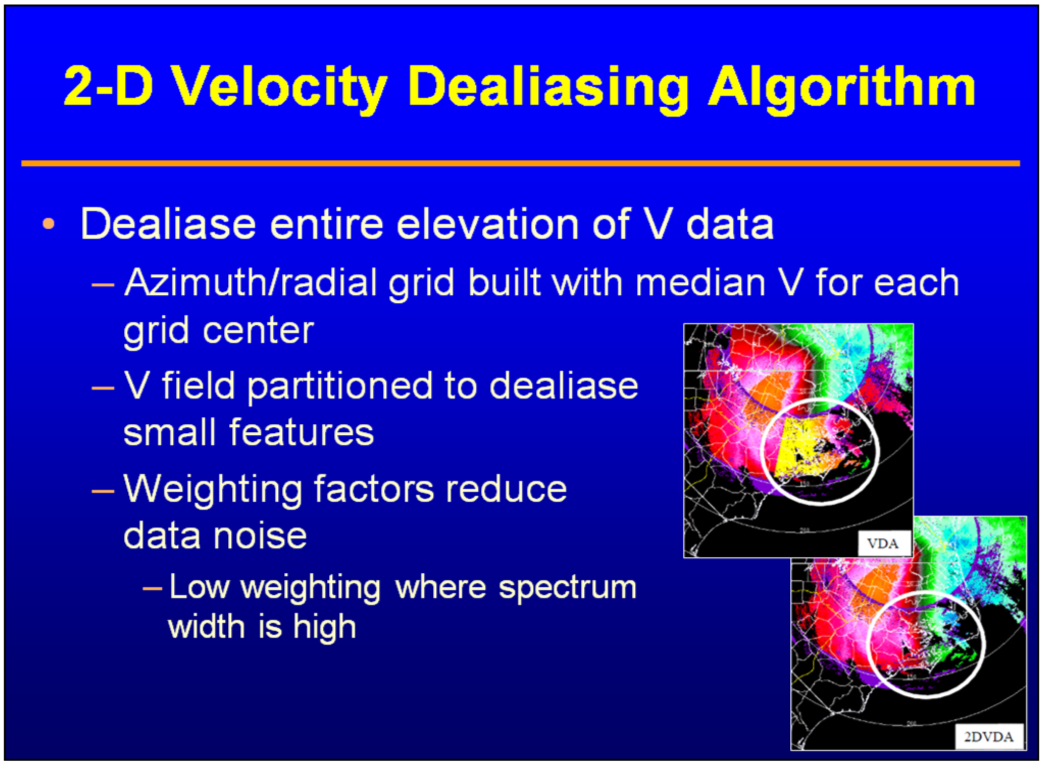
On the RPG HCI main page, the VCP button has a different appearance. The previous VCP button design sometimes caused a resize event when the text on the button changed, e.g. the VCP was changed from 11 to 212. When the RPG HCI was maximized, a VCP change sometimes caused a resizing that included the HCI reverting to the original size.

The appearance change to the VCP button does not affect its behavior. Just as before, when you click the VCP button, the VCP and Mode Control window opens.



The most significant feature of RPG Build 13.1 is the Two Dimensional Velocity Dealiasing Algorithm (2D-VDA), which offers a significant reduction in dealiasing failures. These examples come from an event with storms that were moving so fast that the legacy Velocity Dealiasing Algorithm had numerous dealiasing failures, while the 2D-VDA did much better.

The 2D-VDA is not a replacement for the legacy Velocity Dealiasing Algorithm. It functions as the default velocity dealiasing algorithm, with some considerations which are presented on the following slides.



The 2D-VDA is much more robust than the Legacy VDA, and this slide provides a very brief overview. The overall approach is to use a least squares method to minimize errors in the velocity. For each elevation, 2D-VDA first builds a 2 dimensional grid (azimuth and radial) of the velocity data, with a median velocity value for each grid center point. This serves as a large scale dealiasing step. The velocity field is then partitioned in order to dealiase small scale features such as mesocyclones and tornadic vortex signatures. There are also steps that involve applying weighting factors, primarily to reduce noisiness in the velocity data. For example, bins with a high spectrum width would have lower weighting, because velocity estimates are usually less reliable where spectrum width is high.

2D-VDA Implementation

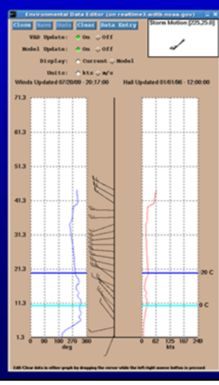
- 2D-VDA is default dealiasing algorithm
- RPG software reverts back to legacy VDA:
  - VCP 121
  - Differing Doppler PRFs in sectors
  - VMI set to 1.94 kts
- All other conditions: RPG uses 2D-VDA
- Switching to/from 2D-VDA automated

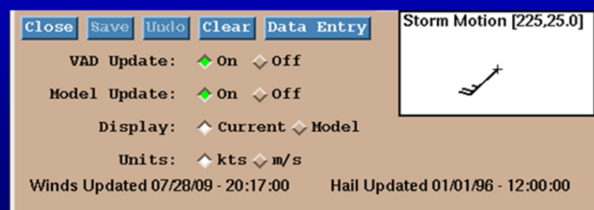
It is important to be aware of how the 2D-VDA has been implemented. Unless it is turned off, the 2D-VDA is the default velocity dealiasing algorithm. There are three conditions where the RPG software will automatically revert back to the Legacy VDA. The first is when VCP 121 is the current VCP. The second is when a VCP with different Doppler PRFs in the three sectors has been downloaded and is active. The third condition is when the Velocity Measurement Increment (VMI) is set to 1.94 kts (the default VMI is 0.97 kts).

Outside of these three conditions, the 2D-VDA will be active unless it is manually turned off in the Algorithms window. The RPG will automatically switch to and from the 2D-VDA as needed.

2D-VDA & the EWT

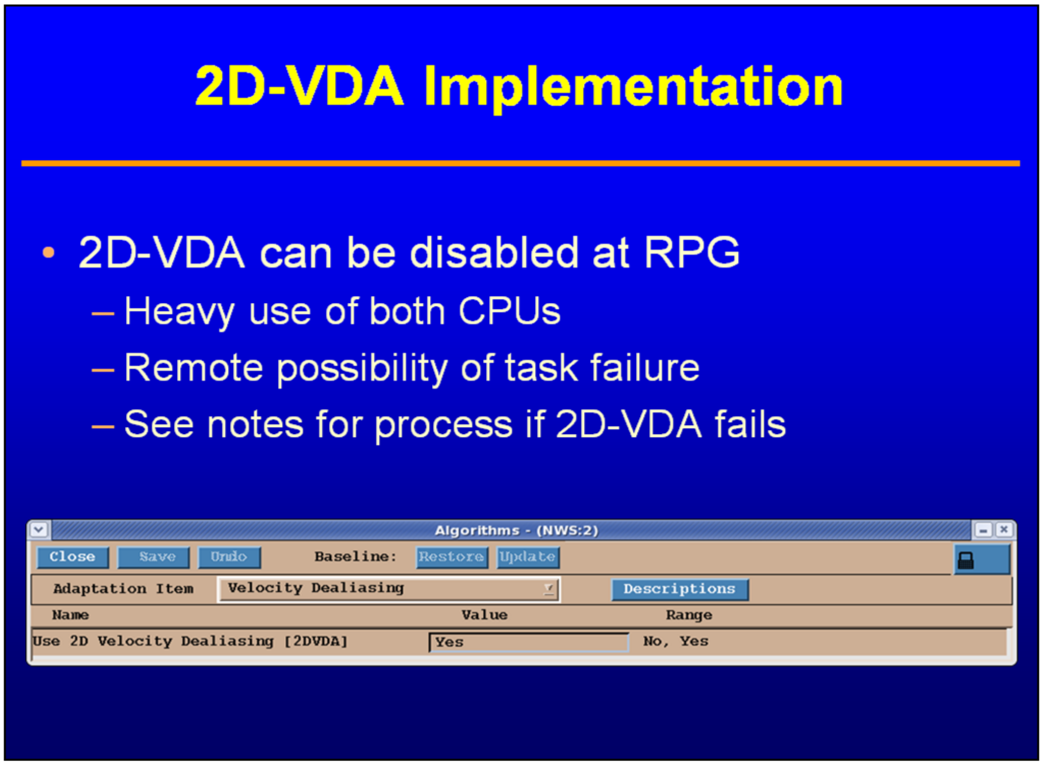
- Environmental Winds Table (EWT)
  - Not used by 2D-VDA (still used by Legacy VDA)
- Need for quality environmental data remains
  - MLDA & 0° C height





The Environmental Winds Table (EWT) supports the performance of the Legacy VDA, and will continue to do so whenever the Legacy VDA is running. The 2D-VDA does not rely on the EWT.

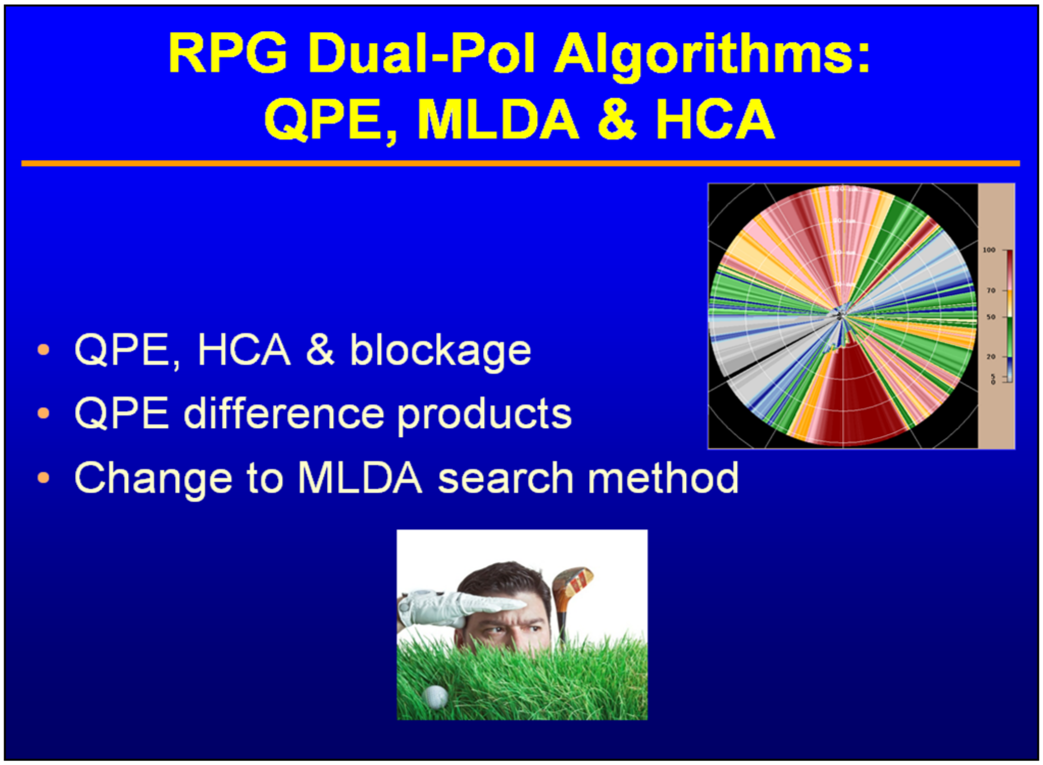
Though the environmental winds will likely be used less often for dealiasing velocity data, maintaining the validity of all the environmental data, such as the 0° and -20° C heights, remains important. For example, the Melting Layer Detection Algorithm (MLDA) will not always have sufficient radar detections to identify a melting layer. When that occurs, the MLDA relies on the RPG 0° C height, which was either manually entered or from the model data.



There is a new entry at the Algorithms window at the RPG, called “Velocity Dealiasing”. The parameter, “Use 2D Velocity Dealiasing”, controls whether the 2D-VDA is used, and the default setting is Yes. Setting this parameter to No is not expected to be needed, but is available because the 2D-VDA makes heavy use of both of the RPG’s CPUs. Though the 2D-VDA has been rigorously tested with a wide variety of weather events, there is a remote possibility of a task failure. The following paragraph describes the process to follow if there is a task failure.

If you notice no new velocity-based products, and suspect that the 2D-VDA has failed, go to the RPG Status window and click on the “Task Failure” and “Control Task Failure” buttons, looking for a failure of the veldeal and/or sr_veldeal tasks. Once you have verified the task failure, perform a “Save Log” process. Click the yellow triangle icon at the top of the MSCF interface, which launches the “Save Log” window. Provide a name for the log file in the description field and click Start. Once the save is complete, if you do not see your log file in the list, click on “Update File List”. Multiple files that have been saved will appear, and can be highlighted. Clicking the Copy button will copy any highlighted files to CD. As soon as it is convenient, notify the WSR-88D Hotline of the incident, copy the log file(s) to a CD, and mail the CD to the Hotline.

To revert back to the Legacy VDA if the 2D-VDA has failed, unlock the Algorithms window, and set the “Use 2D Velocity Dealiasing” parameter to “No”. Then restart the RPG.



Now for the Build 13.1 changes that are related to the RPG Dual-Pol algorithms, Quantitative Precipitation Estimation (QPE), Hydrometeor Classification Algorithm (HCA), and Melting Layer Detection Algorithm (MLDA). There are adjustments to how the QPE and HCA process partial beam blockage, improvements to the QPE difference products, and a change to how model data are searched for a melting layer within MLDA.

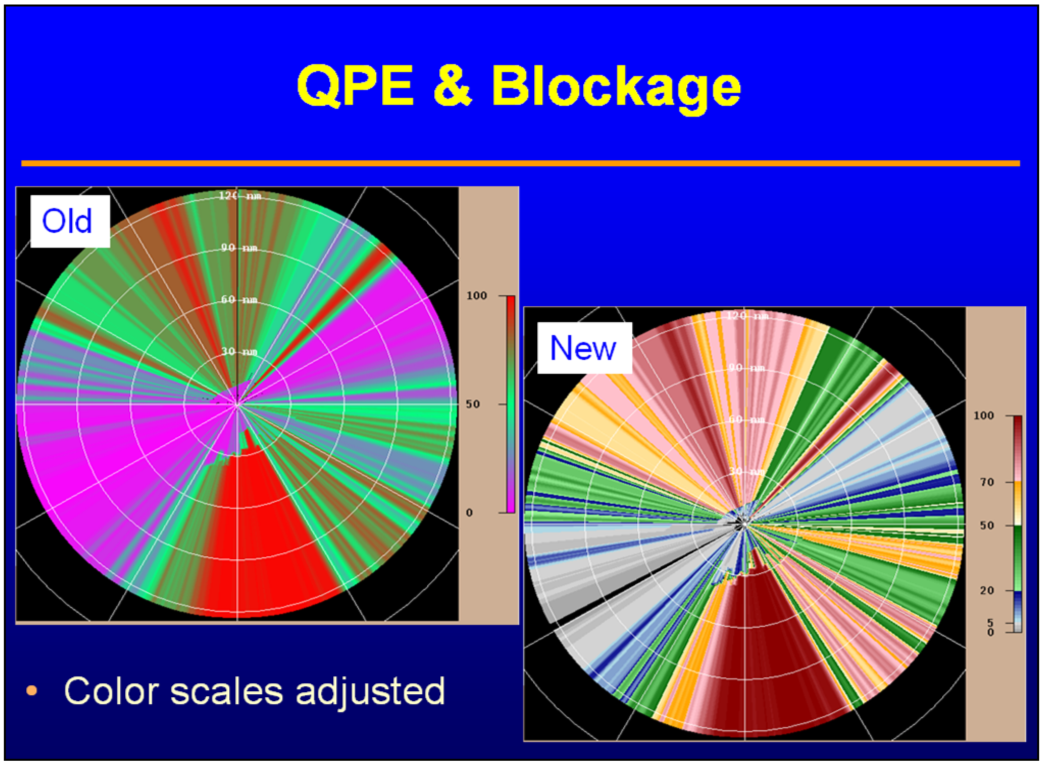
QPE, HCA, & Blockage

- Even flat terrain sites have non-zero blockage
  - QPE: Minimum blockage 5% initiates adjustments to Z and allows for R(KDP)
  - HCA: Uses partial beam blockage adjustment to Z from QPE

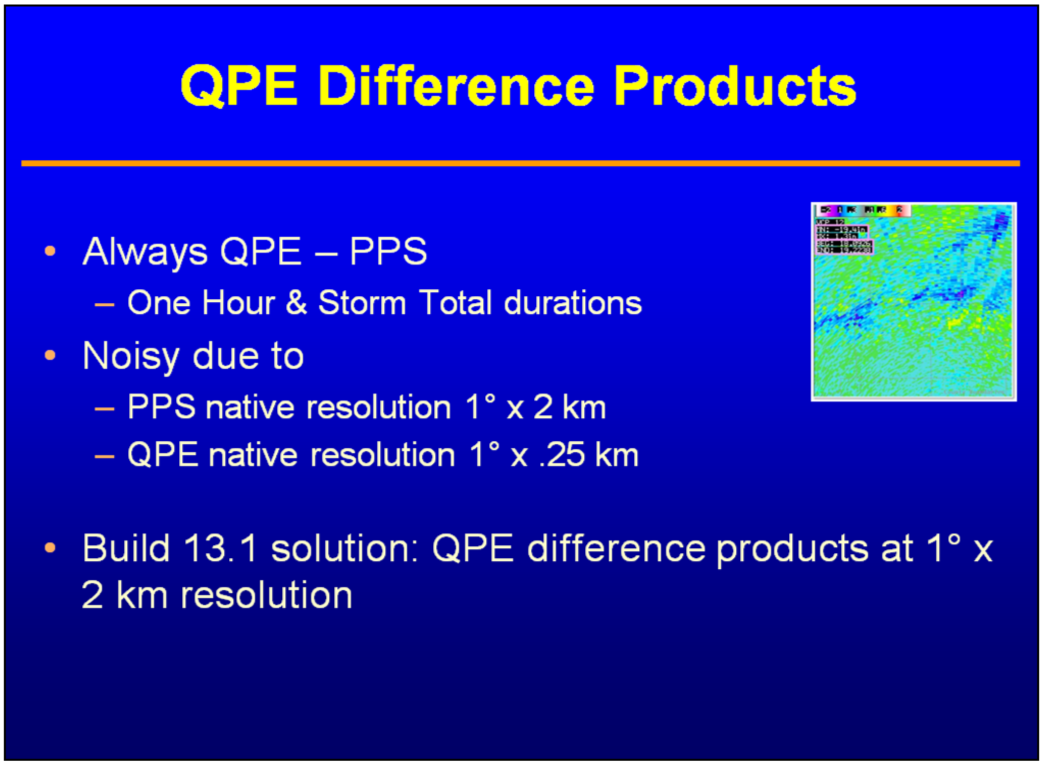
Percent Blockage	dBZ Added	Percent Blocked	dBZ Added
5 %	+0.34 dBZ	40 %	+1.97 dBZ
10 %	+0.45 dBZ	45 %	+2.45 dBZ
15 %	+0.58 dBZ	50 %	+3.01 dBZ
20 %	+0.75 dBZ	55 %	+3.65 dBZ
25 %	+0.97 dBZ	60 %	+4.38 dBZ
30 %	+1.24 dBZ	65 %	+5.18 dBZ
35 %	+1.57 dBZ	70 %	+6.05 dBZ

It turns out that areas with terrain that we humans think of as flat still have some radials with non-zero beam blockage. Both QPE and HCA have steps that rely on the percent of beam blockage, but blockages of as little as 1-4% were introducing logic that wasn't intended to be used.

For QPE, RPG Build 13.1 sets a minimum blockage of 5% for adjusting the dBZ value to account for partial beam blockage, as well as allowing the use of R(KDP) for certain Hybrid Hydroclass (HHC) values. This table shows the added dBZ values for blockages between 5 and 70%, and these adjustments are used by both QPE and HCA.



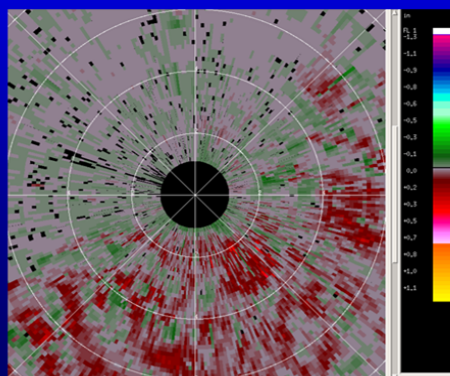
The blockage files used by both the PPS and the QPE are viewable at the RPG, and they are elevation by elevation. With Build 13.1, the color scale and legend have been updated to be more meaningful with respect to these algorithms. There are now color changes at the relevant percentage values for both PPS and QPE. For example, the PPS applies a correction to the Z value for partial blockage up to 50%. The cutoff from green to yellow at 50% makes it easier to see which radials and which ranges have a correction applied and which ones require a higher elevation angle.

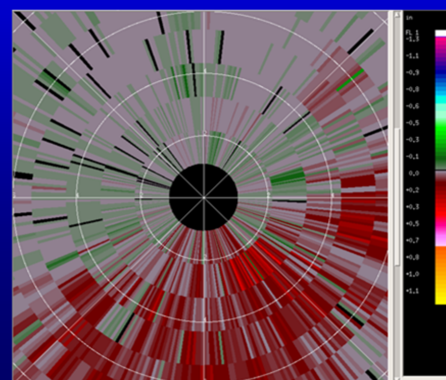


The Dual-Pol Quantitative Precipitation Estimation (QPE) Algorithm generates two difference products, with the durations of one hour and storm total. For both durations, the products represent the QPE accumulations minus Legacy Precipitation Processing System (PPS) accumulations. The resolution of these difference products was originally set to the same resolution as all the QPE products, 1° x .25 km. However, since the native resolution of the PPS accumulations is 1° x 2 km, the difference products were performing this subtraction from two data sets with different native resolutions. Thus the QPE difference products were sometimes noisy in appearance and difficult to interpret. Starting with RPG Build 13.1, the QPE difference products have a resolution of 1° x 2 km.

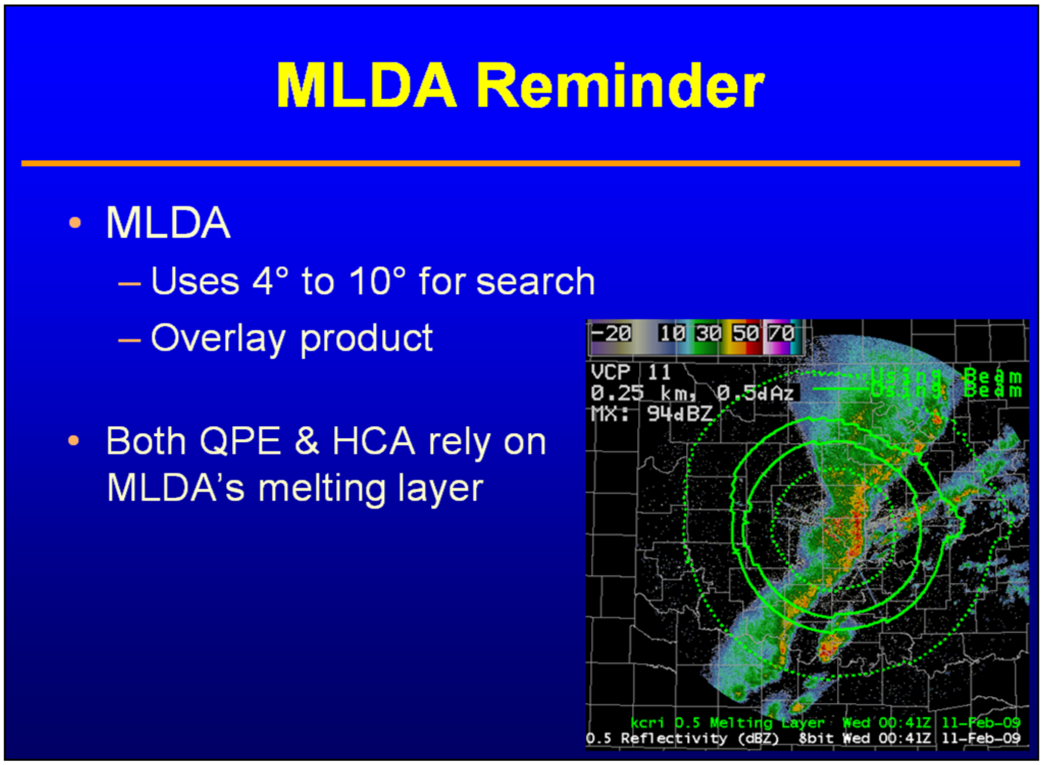
QPE Difference Products

- DSD before 13.1 (left); DSD after 13.1 (right)
  - Warm colors QPE > PPS; Cool colors QPE < PPS
- Less noisy data on RPG 13.1 DSD



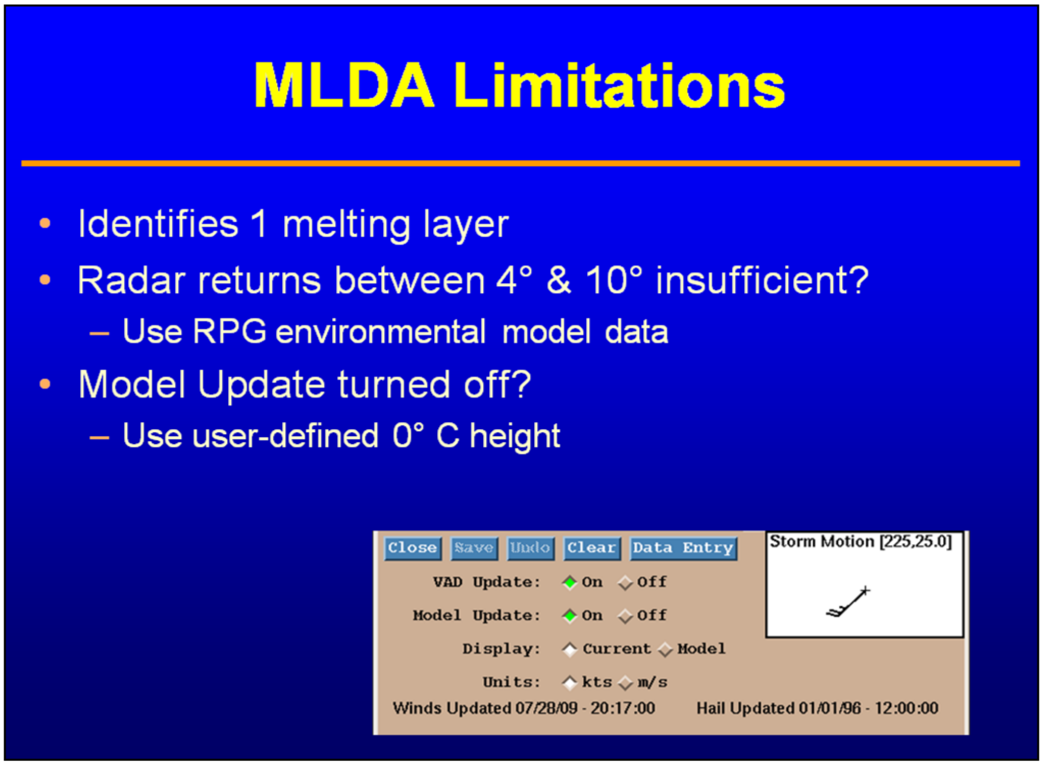


Here's an example of a Digital Storm Total Difference (DSD) product with the pre-Build 13.1 resolution on the left and the Build 13.1 resolution on the right. The colors likely look unfamiliar as this is from a display tool at the RPG itself. As with the AWIPS versions of the difference products, warm colors imply that the QPE estimates are higher than the PPS, while cool colors imply that the QPE estimates are lower than the PPS. What is important here is the change in appearance with RPG Build 13.1 product resolution on the right, and an overall reduction in noisiness of the data.



The MLDA uses data (legacy and Dual Pol) from 4 to 10 degrees to identify the melting layer. These higher elevations are necessary to avoid clutter and other low level data quality problems. An overlay product is generated for each elevation angle that depicts where that elevation angle would intersect the computed melting layer.

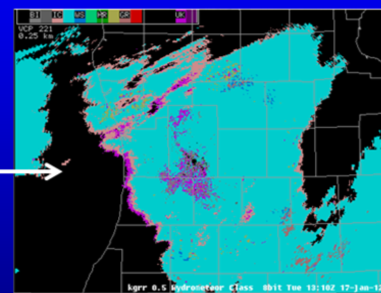
MLDA works best with widespread returns that are deep enough for the 4 to 10 degree search to be successful. Awareness of MLDA's limitations is important for interpretation the other Dual-Pol RPG algorithms, HCA & QPE.



One of the limitations of the MLDA is that it identifies just one melting layer, though Mother Nature sometimes provides multiple, or very complex melting layers. Sometimes the radar returns between 4° & 10° are insufficient for the MLDA to find the melting layer. In that case, the RPG environmental model data are used by default. At the RPG, the only choice is whether or not the model data are used for updating the environmental data (the specific model that is sent by AWIPS is determined within AWIPS). If Model Update is turned off, the user-defined RPG 0° C height is then used.

Change to MLDA Model Data Search Method

- Model data search originally “bottom up”
  - Multiple melting layers? Lowest one used
  - Cold season & actual melting layer very low? Entire column assumed to be < 0° C



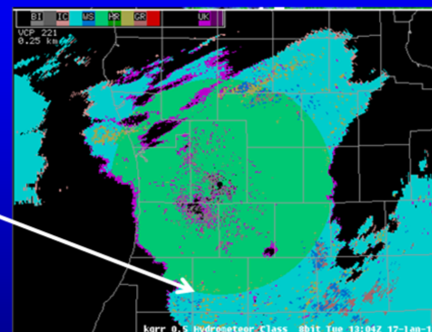
- QPE uses 2.8R(Z) above top of melting layer
  - Using lowest enhances areal coverage of overestimate

When radar returns are insufficient for the MLDA to find a melting layer, and model data are turned on at the RPG, the model data are searched for a melting layer. Previously, the search technique was “bottom up”. This meant that if multiple melting layers were present, the lowest one was used. This bottom up approach also exacerbated some issues during the cold season, where melting layers are complex and often low to the ground. In some cases where model data are used, the entire atmosphere was assumed to be below freezing. In this 0.5° Hydroclass (HC) product, that assumption led to the assignment of dry snow throughout the radar umbrella, which is not reality.

QPE uses 2.8R(Z) for rainfall estimation above the melting layer. This multiplier is the result of research conducted in Oklahoma, with mostly warm season events (high melting layers at long range). It often results in an overestimate during the cold season, and the QPE was not designed to determine water equivalent from dry snow. The lowest melting layer that results from the “bottom up” approach can enhance the areal coverage of this cold season overestimate.

Change to MLDA Model Data Search Method

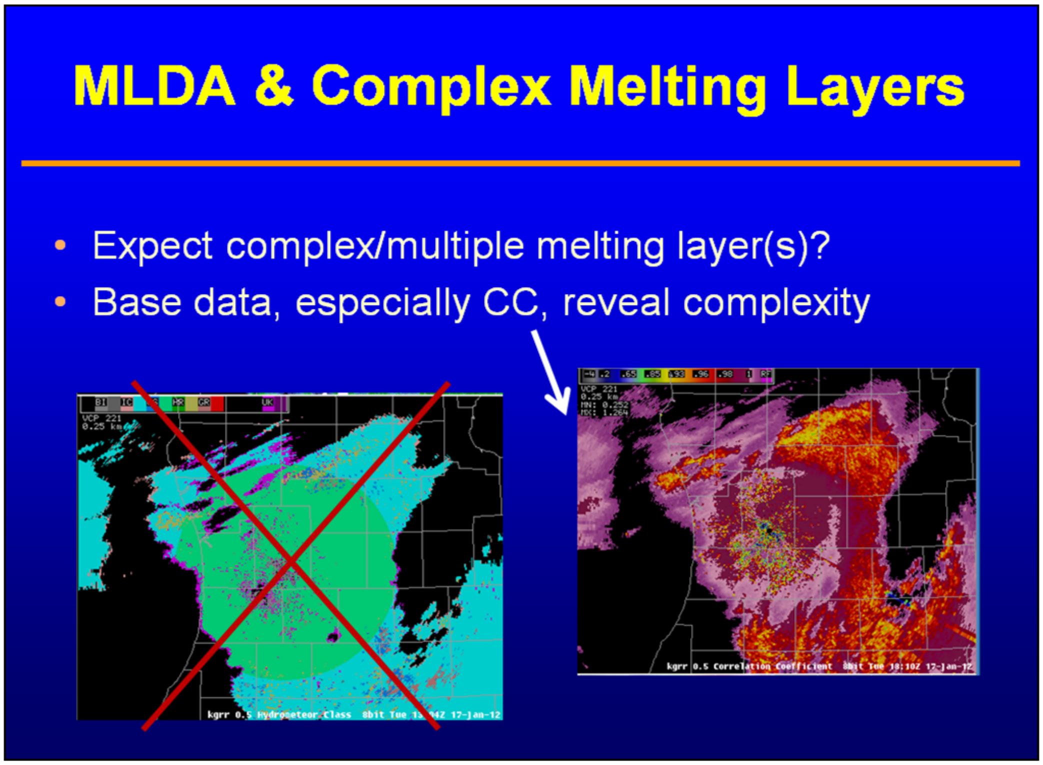
- Build 13.1 model data search “top down”
  - Likely closer to melting layer based on radar returns from 4° to 10° search



- Since QPE uses 2.8R(Z) above top of melting layer
  - Using highest reduces areal coverage of overestimate

RPG Build 13.1 changes the model search technique to “top down”. The result is that where multiple melting layers are present, the highest one is used. The highest identified by a model search is more likely to be the one detected from the base data, if there had been sufficient radar returns. This 0.5° Hydroclass (HC) product shows a transition from light to moderate rain (green) to dry snow (light blue) that is well above the surface.

QPE uses 2.8R(Z) for rainfall estimation above the melting layer. This multiplier is the result of research conducted in Oklahoma, with mostly warm season events (high melting layers at long range). It often results in an overestimate during the cold season, and the QPE was not designed to determine water equivalent from dry snow. The higher melting layer that results from the “top down” approach reduces the areal coverage of this cold season overestimate.



The MLDA, just like the other RPG algorithms, is subject to error and cannot be used effectively without awareness of its limitations. In this 0.5° Hydroclass (HC) product, the abrupt transition from light to moderate rain (green) to dry snow (light blue) rain is the algorithm version of a melting layer. However, we humans know that it is more complex than that. Given enough radar returns, Correlation Coefficient is usually the best product for seeing the depth, shape, and change over time of the melting layer. This case is a nice example of the difference between an algorithm melting layer and a base data melting layer.

Thank You For Your Time

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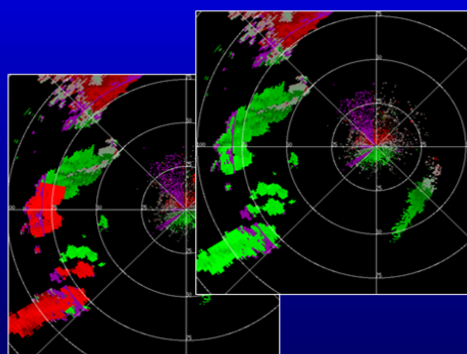

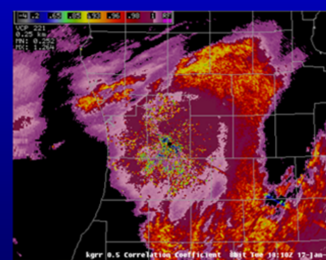

Thank you for your time and please let me know if you have any questions.