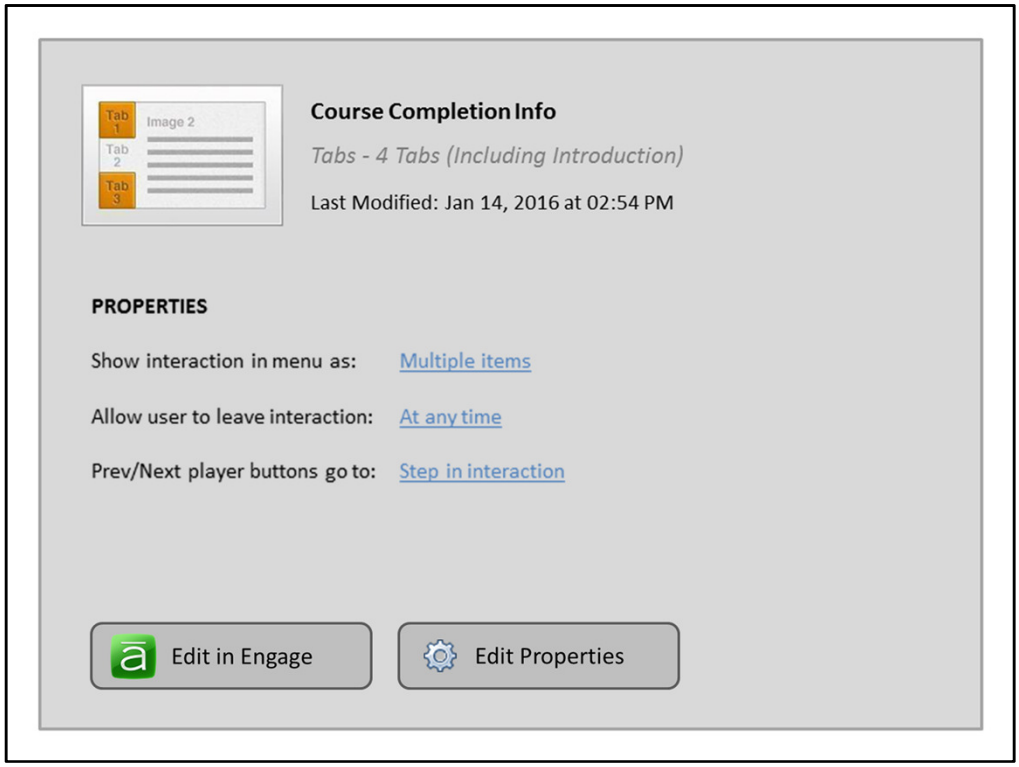
Welcome to the RDA/RPG Build 17.0 Training, presented to you by Jami Boettcher and Greg Schoor of the Warning Decision Training Division.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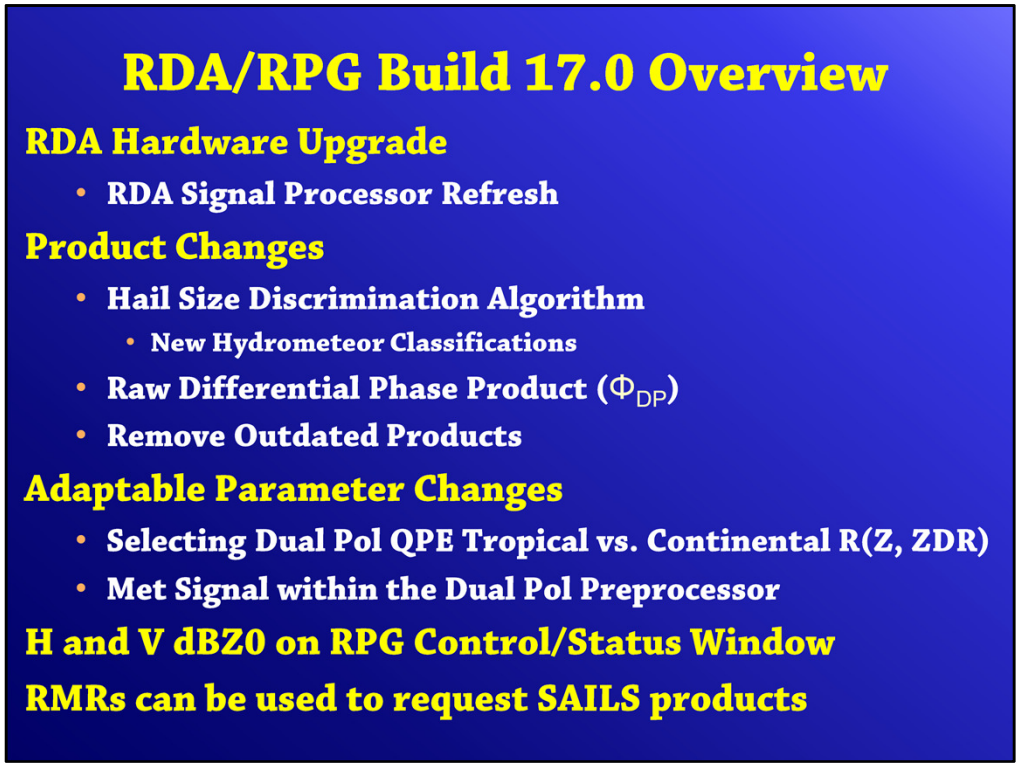
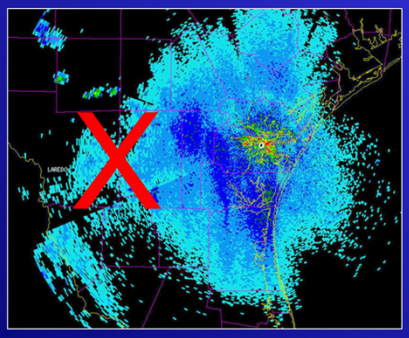


In RDA/RPG Build 17.0, there are several enhancements that have operational impacts for internal and external users alike. More recent builds had notable software changes like AVSET, SAILS, and MESO-SAILS but Build 17.0 is no less important with it's cluster of enhancements.

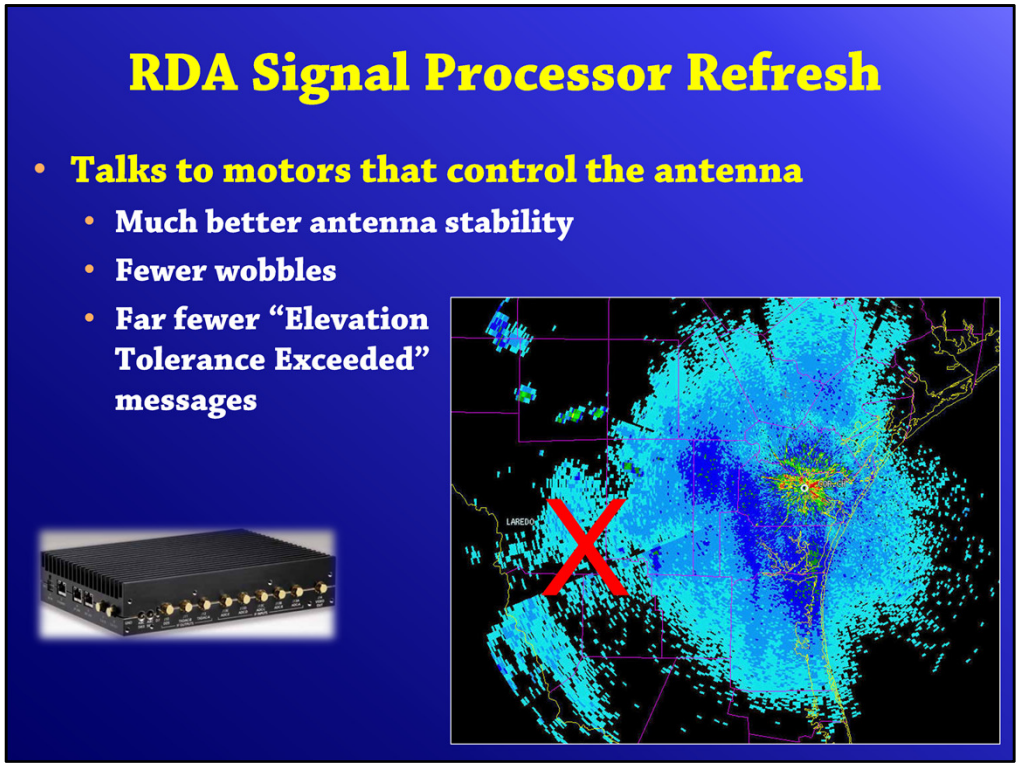
The first one is critical for the quality of the data you receive: an upgrade to the RDA Signal Processor – and we'll see what effect that will have. Next, for the product changes, we'll start off with the most notable one – the new Hail Size Discrimination Algorithm, which splits up the hail category into sizes for the Dual Pol Hydrometeor Classification Algorithm, which generates the HCA product. Also for Dual Pol, we're adding in the Raw Differential Phase product, Φ_{DP}, and see what its usage could be. We're also removing a number of radar products that have either been replaced by higher resolution versions or are no longer used for other reasons. Finally, there are some key adaptable parameter changes, calibration-related information on the RPG Control/Status window, and an update that allows for SAILS cuts to be available via One Time (OTR) or Radar Multiple (RMR) Requests.

RDA Signal Processor Refresh

- **New RDA Receiver and Signal Processor!**
  - **RVP900**
  - **Able to support current and future base data generation needs, plus….**



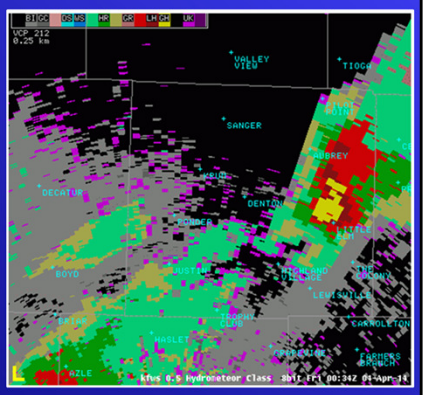
The primary purpose of Build 17.0 is updating the RDA signal processor. This is another phase in a series of builds that will extend the life of the NEXRAD fleet. The new signal processor, the RVP900, is able to support all the current and future base data generation needs. There is only one difference that users may notice, and we'll present that on the next slide.



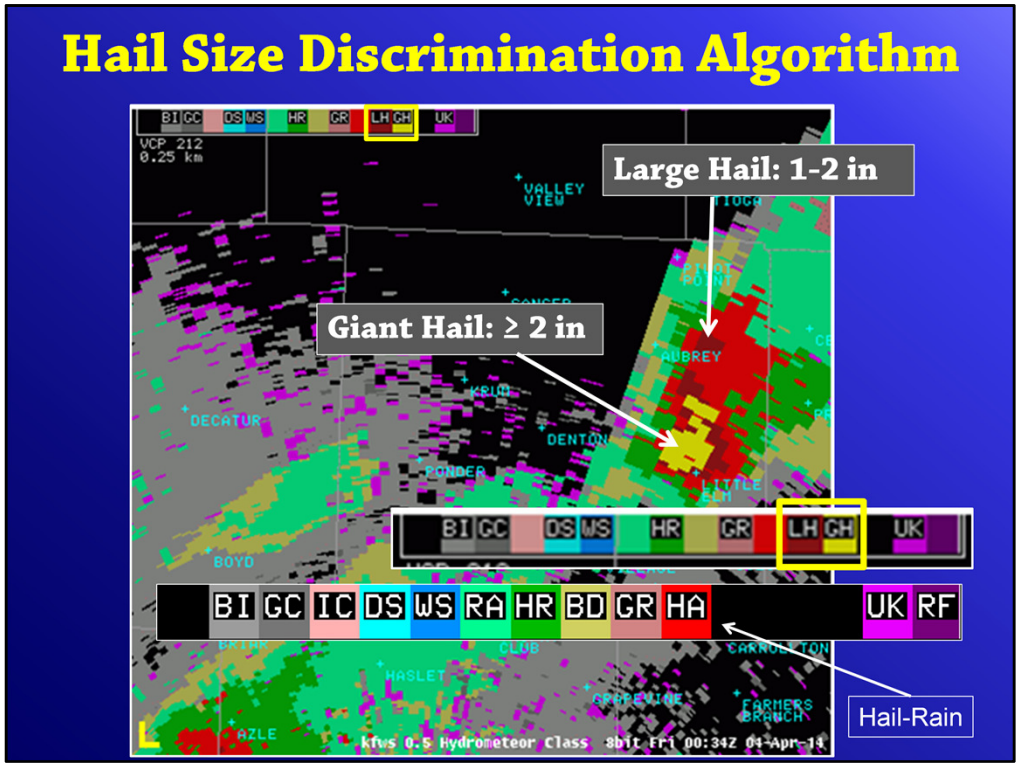
The RVP900 has a different way of controlling the antenna, and this is good news. Did you even know that this black box talks to the motors that control the antenna? Well it does! The result is better antenna stability, which means fewer wobbles. You may have seen cases like this one where there is a disconnect in the data at an elevation and/or there was an "Elevation Tolerance Exceeded" message. This happened when the actual elevation at the beginning of the data collection differs slightly from the actual elevation at the end. With the improvement in antenna stability, this will be a rare event in the future.

Hail Size Discrimination Algorithm

- **Two New Hydrometeor Classifications:**
  - **Large Hail: 1-2 in**
  - **Giant Hail: ≥ 2 in**
- **Displayed on HCA products**
  - **Hydrometeor classification is a key dual pol benefit**
- **Requires height of 0° C & -25° C wet bulb temp**
- **Can be turned "off"**



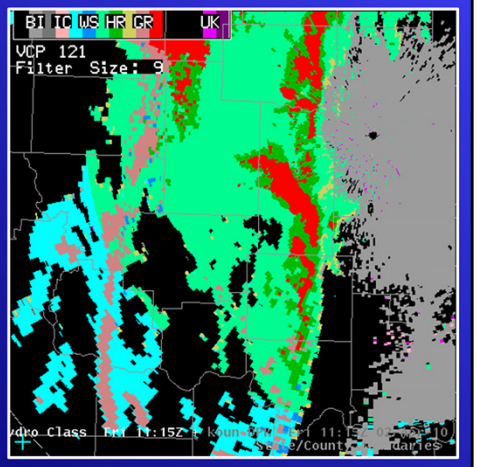
The most important addition from Build 17.0 for decision makers is the Hail Size Discrimination Algorithm (HSDA), which adds two new categories to the hail spectrum, large and giant hail. Using Legacy and Dual Pol base data, the HSDA estimates hail size and adds two new hydrometeor classifications:
Large Hail, which is between 1 and 2 inches in diameter and Giant Hail, which is greater than or equal to 2 inches in diameter.
These new classifications will be displayed on the Hydrometeor Classification Algorithm (HCA) products, and we'll take a closer look at that on the next slide. The HSDA needs the height of the 0°C and -25°C wet bulb temperatures, and we'll also look at that. Finally, the HSDA can be turned "off" if there are any issues, reverting back to the single hail hydrometeor classification.



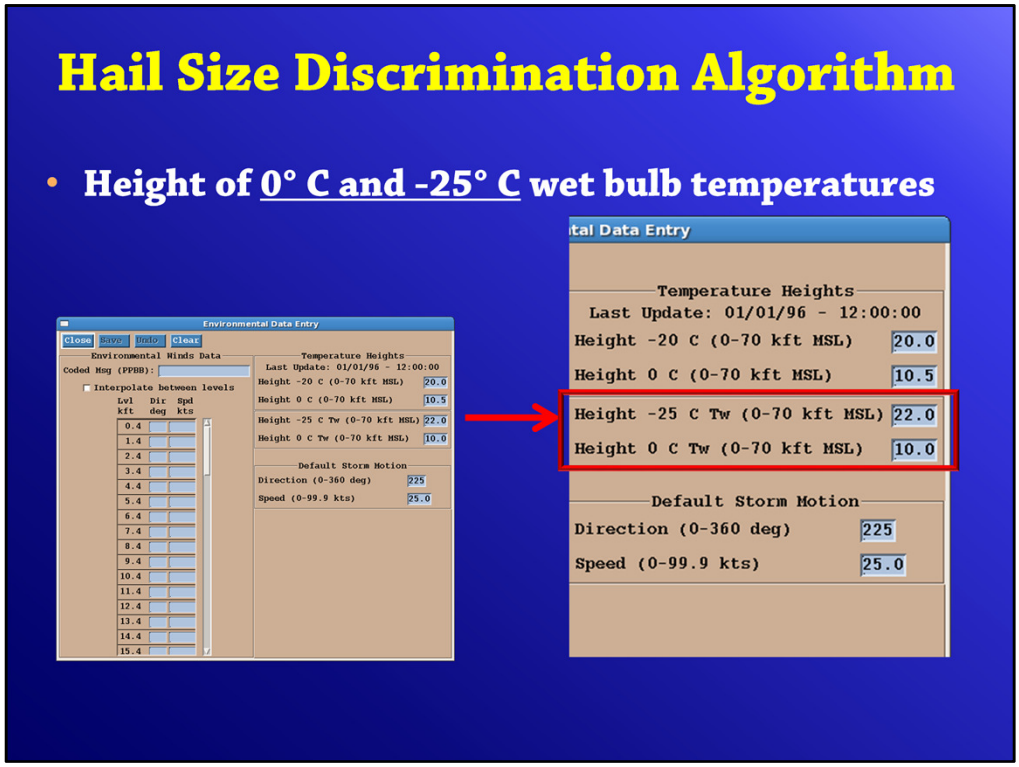
Here's a closer look at these new hail classifications. This is an HCA product at 0.5° elevation, and the storm is at a far enough range to sample the hail core. At the bottom of the slide is a close up of the legend without the new hail hydroclasses. The bright red is "hail possibly mixed with rain", the only hail hydroclass before Build 17.0. With HSDA, the two new hail hydroclasses are in dark red for Large Hail (LH) and Yellow for Giant Hail (GH).

Hail Size Discrimination Algorithm

- **QPE produces the Hybrid Hydroclass (HHC) product**
- **Large Hail and Giant Hail hydroclasses *not* on HHC**
  - **R(KDP) used for all Hail hydroclasses (HA, LH, GH)**



Recall that the QPE produces the Hybrid Hydroclass (HHC) product, which displays the hydroclass values used to choose the rain rate equation for the volume scan. It can be helpful for quality controlling the QPE rainfall accumulations. The QPE does not do anything new with these new hail hydroclass values. The R(KDP) equation is used to generate rainfall rate for all three hail hydroclasses, hail possibly mixed with rain (HA), large hail (LH), and giant hail (GH). You will only see the HA hydroclass on the Hybrid Hydroclass (HHC) product for the bins with hail.

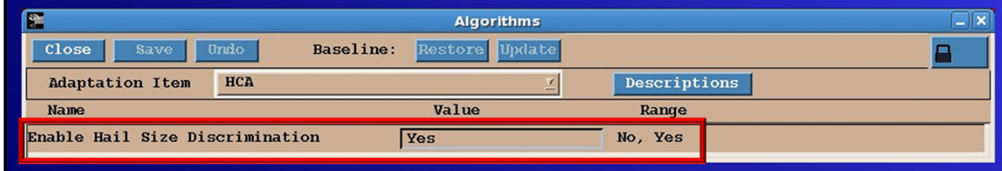


To support the Hail Size Discrimination Algorithm, it is important to keep the heights of the 0° and -25° C wet bulb temperatures current in the Environmental Data at the RPG. These values will be computed from the existing environmental model data received from AWIPS. As with other environmental data, it is recommended that these wet bulb temperature heights be checked periodically for quality control.

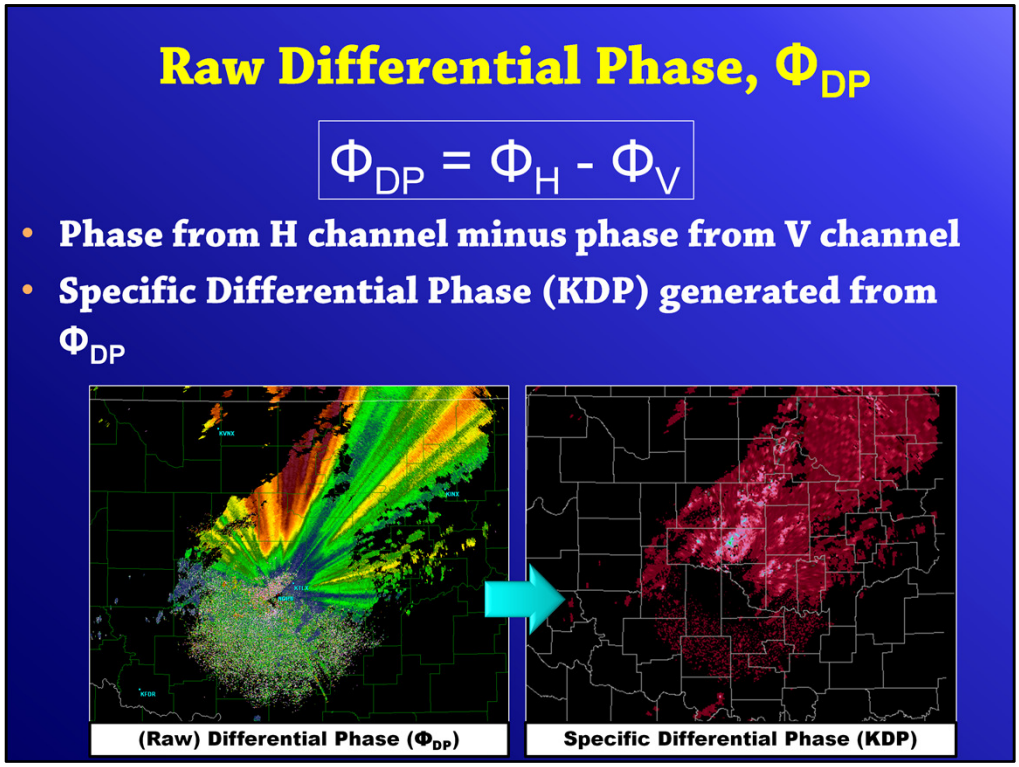
As a reminder, the other temperature heights are for the Hail Detection Algorithm (HDA), which has nothing to do with the Dual Pol RPG algorithms.

Hail Size Discrimination Algorithm

- **Option to turn off HSDA**
  - **Keep legacy Hail category**
  - **Default is Yes**
  - **Not expected to be needed, but…**

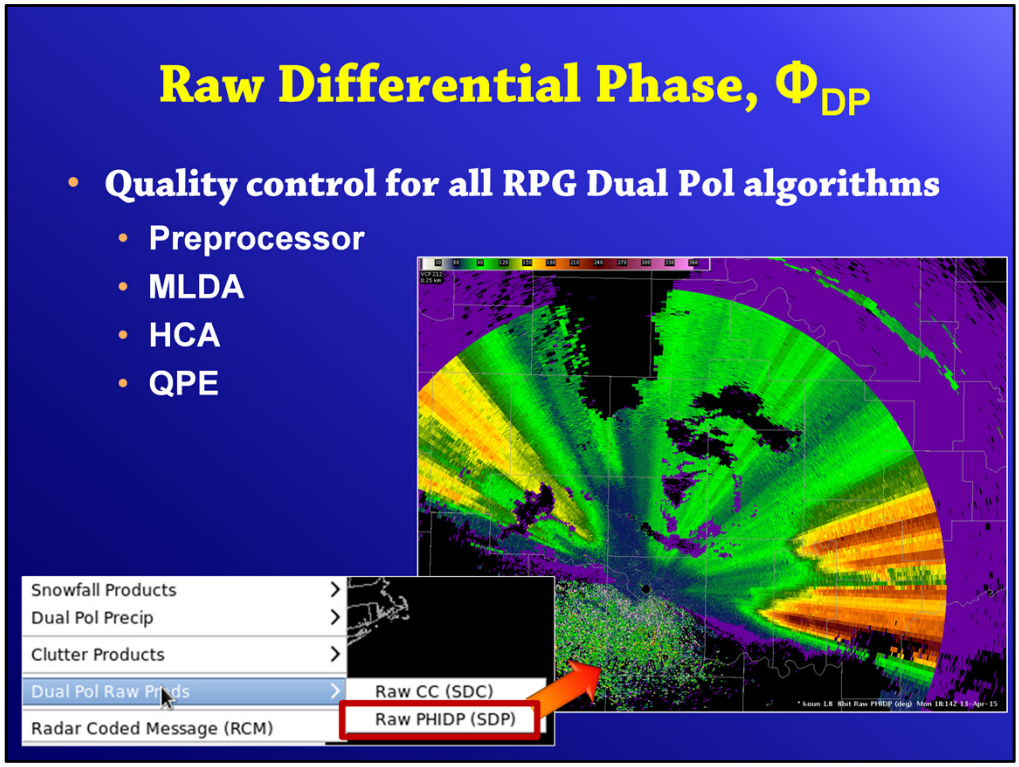


Finally, if there is any type of issue with the HSDA, it can be turned off at the Algorithms window under HCA. The parameter is “Enable Hail Size Discrimination”, the default value is Yes, and there is currently no expectation that it would need to be disabled. However, it is there if you need it!

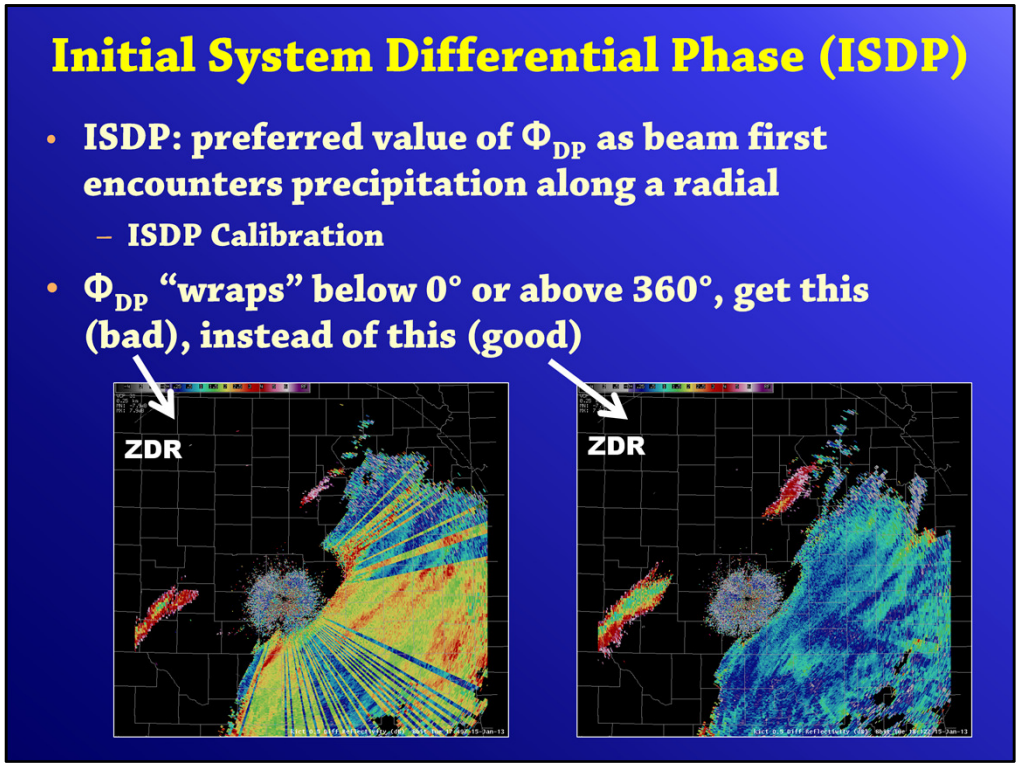


Thank you, Jami! This is Greg Schoor, the tag team Build Training Instructor and I'll take us on out the rest of the way, starting with the Raw Differential Phase.

The Raw Correlation Coefficient product became available in Build 16.1 – so, don't forget to take that training module as well. Now, with Build 17.0, the Raw Differential Phase product, or Φ_{DP}, is available. If you can remember back to the initial Dual-Pol training a few years ago, recall that one of the base Dual-Pol products you've had all along, Specific Differential Phase, or KDP, is a product of Φ_{DP}. On the left is an example Φ_{DP} product, and on the right is the associated KDP product.



The menu stream in AWIPS describes this as Raw Φ_{DP}, which means the base data that are directly sent to the RPG from the RDA. You see there in the menu, the product name is "Raw PHIDP" spelled out, but we will continue to use the greek symbol Φ, to avoid confusion – but they are the same thing. Since Φ_{DP} is an input for all the Dual Pol RPG algorithms, the Raw Φ_{DP} product can be used for quality control monitoring. Φ_{DP} increases with liquid water content down the radial, and you can expect to see the Φ_{DP} gradients as the beam enters rainfall along the radial. The stronger the rainfall gradient along the radial, the stronger the Φ_{DP} radial gradient.

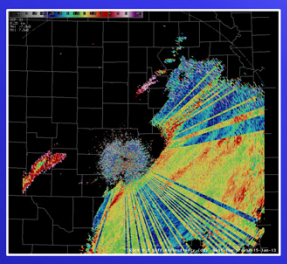


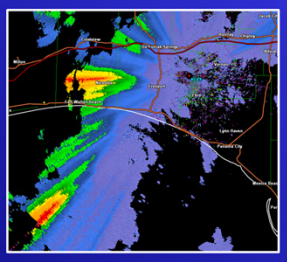
Now, the Initial System Differential Phase (ISDP) is a preferred value of Φ_{DP} as the beam first encounters precipitation along a radial. The process for setting the parameters such that this preferred Φ_{DP} occurs is known as the ISDP Calibration. Without this preferred value, the risk is increased that Φ_{DP} will wrap below 0° or above 360° as it changes along the radial. This wrapping results in poor dual pol data quality, such as the streaks on ZDR on the lower left image.

The two examples of ZDR show the improvement in data quality before on the left, it is run through the ISDP Calibration process and you get the result on the right.

ISDP and Raw Φ_{DP}

- **Preferred ISDP value is 60°**
  - **Reduces risk of Φ_{DP} going below 0°**
- **Can use Raw Φ_{DP} for quality control**
- **ISDP Calibration needs to be run**
  - **When ZDR stripes occur**
  - **When hardware changes/adjustments are made**
  - **Need precip within 5-30 km**





When data is processed through ISDP, the preferred value that is set is 60°, which reduces the risk of Φ_{DP} wrapping below 0°. The Raw Φ_{DP} product can be used to quality control the Φ_{DP} data and help determine when ISDP Calibration is needed. The ISDP Calibration process needs to be run periodically, especially when the "striping" in ZDR becomes apparent. It is recommended that the ISDP Calibration process be run whenever ZDR stripes occur, and whenever changes or adjustments are made to the hardware (some further details are listed in the notes). Precipitation must be present within 5-30 km (~3-19 mi) during the ISDP Calibration.

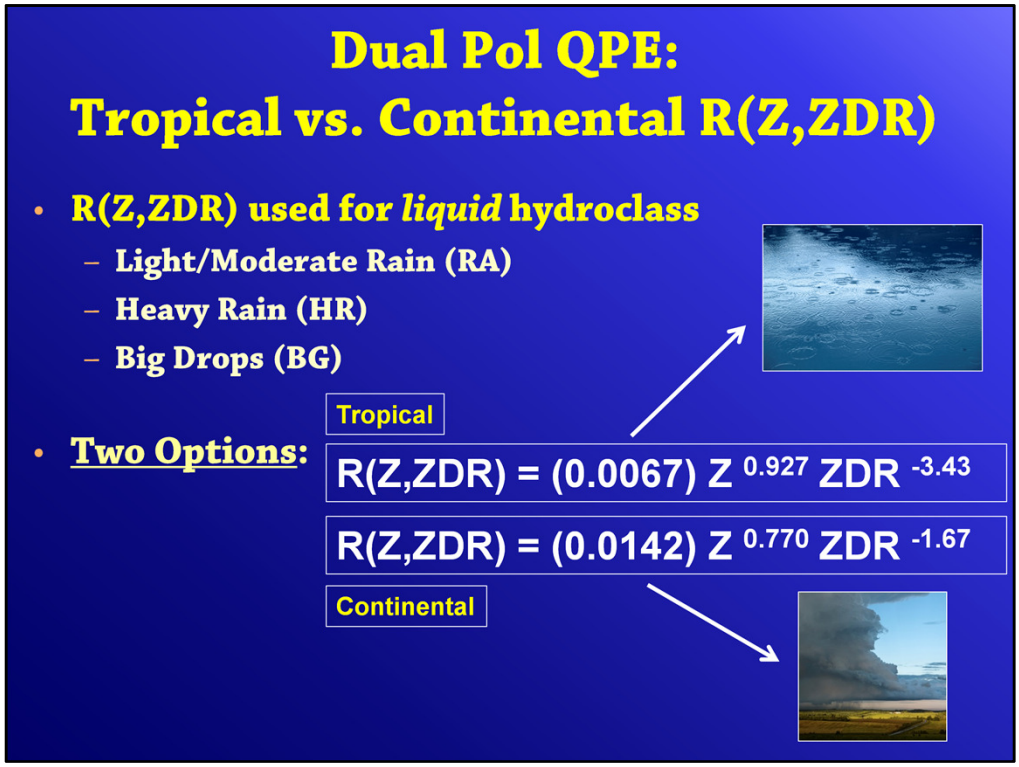
Also, it should be run any time the hardware in the transmit or receive path is modified, replaced, or adjusted.
This calibration should be run every time a component is replaced or adjusted, in either the horizontal or vertical transmit or receive path.

Remove Outdated Products

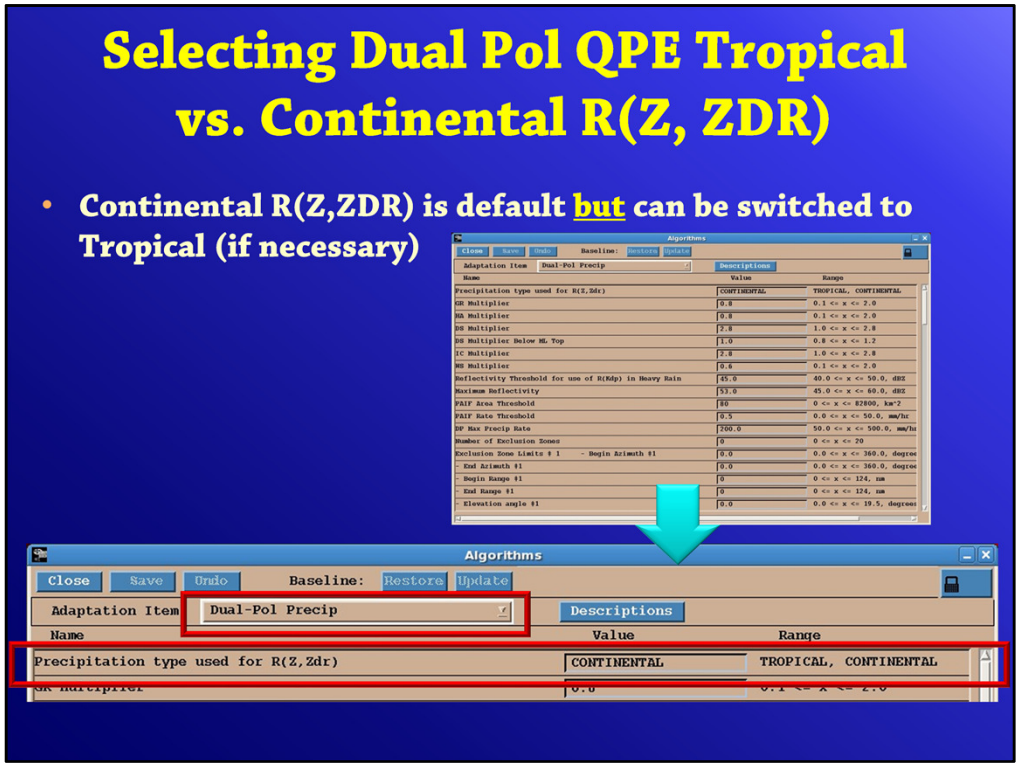
- **Outdated data levels and range resolution**

Product Name	Product Numbers	Data Levels	Range Resolution
Dual Pol (ZDR, CC, KDP, HCA)	158, 160, 162, and 164	16 (4 bit)	.54 nm
Composite Z AP-Edit	95, 96	8 (3 bit)	.54 nm, 2.2 nm
Cross Section (Z, V)	85, 86	8 (3 bit)	.27 nm, .27 nm
Composite Z	35	8 (3 bit)	.54 nm
Base SW	29	8 (3 bit)	.27 nm
Base V	22, 23, and 24	8 (3 bit)	.13 nm, .27 nm, and .54 nm
Base Z	16, 17, and 18	8 (3 bit)	.54 nm, 1.1 nm, and 2.2 nm
Base Z	21	16 (4 bit)	2.2 nm

In most build updates, products are added to the available suite but also, in this Build 17.0 update, a number of outdated products are being removed. Most of these are legacy base products and Dual-Pol products with coarse spatial resolution or outdated data levels. Take a brief look through these before heading to the next slide.



For those of you who became accustomed to legacy tropical vs. continental Z/R considerations, this may be familiar territory. But now, we're talking about Dual-Pol QPE R(Z,ZDR) considerations and we will introduce this idea of hydroclass – which are the categories from the HCA or Hydrometeor Classification Algorithm product. Where the hydroclass is liquid, below the melting layer – for instance, the rain rate is calculated from the R(Z,ZDR) equation. The three hydroclass values that use R(Z,ZDR) are: Light/Moderate Rain (RA), Heavy Rain (HR), and Big Drops (BG). The Tropical R(Z,ZDR) equation has performed better in events dominated by the warm rain process, while the Continental R(Z,ZDR) equation has performed better in events with at least some convection.



With Build 17.0, the Continental R(Z,ZDR) will become the default setting, since it has been shown to provide better QPE estimates for the majority of the CONUS. However, if the desire is to switch over to Tropical, that is controlled at the Adaptable Parameters Algorithms window. Under that first drop-down menu, next to “Adaptation Item”, select “Dual-Pol Precip”. Previously, the selection between Tropical and Continental had to be made by selecting the three different multipliers and exponents in the two equations. But in Build 17.0, the choice is made by simply selecting “Tropical” or “Continental”.

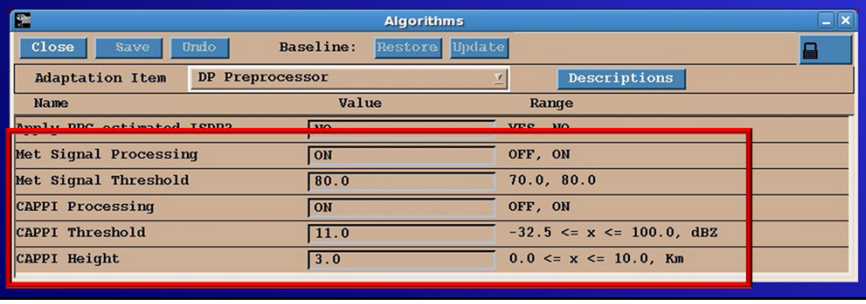
Met Signal Within Dual Pol Preprocessor

- **Designed to support identification of met vs. non-met targets within Dual Pol Preprocessor**
- **Preprocessor:**
  - **Z, PhiDP (Φ_{DP}), CC, ZDR base data are recombined (0.5 to 1.0 azimuth) and smoothed before the dual pol products are generated**
  - **Also analyzed for non-met signal**
- **Met Signal adaptable parameters**

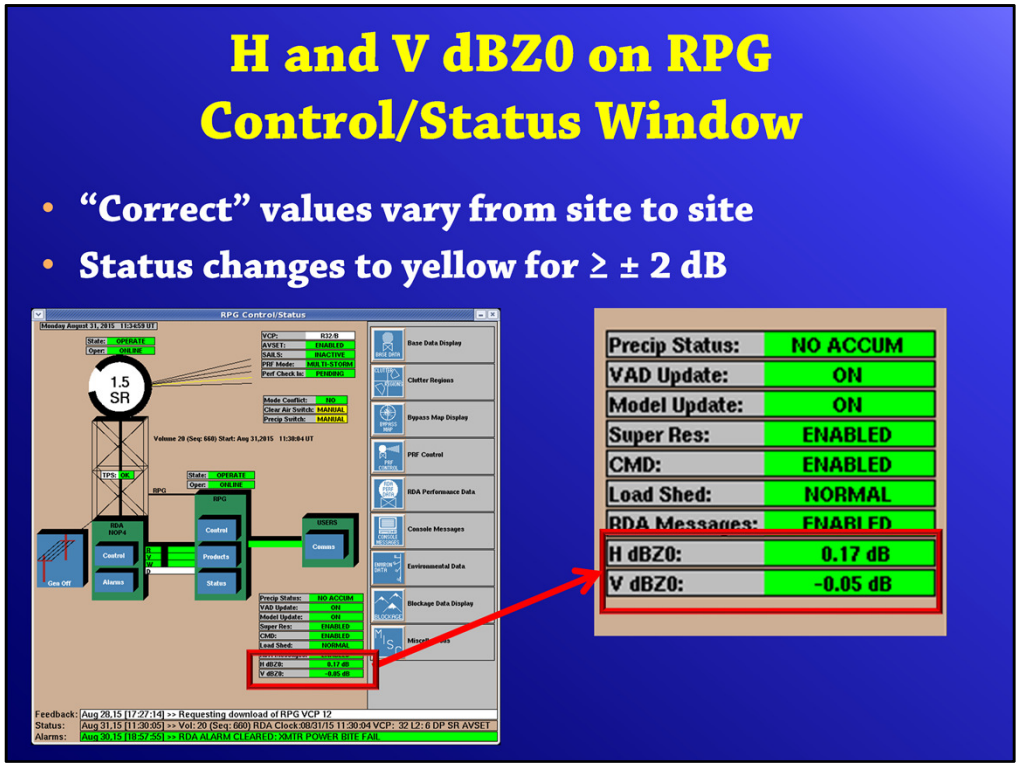
Now, for an additional concept, we'll introduce you to Met Signal. Met Signal is a component of the RPG Dual-Pol Preprocessor, and is a method to distinguish between meteorological from non-meteorological data. Since this runs at the RPG, it is not a filter, like clutter filtering done at the RDA. Instead, it is an identifier. As a reminder, the RPG Dual-Pol Preprocessor recombines and smooths Z, PhiDP (Φ_{DP}), CC, and ZDR base data before the Dual-Pol products are generated. There are a five adaptable parameters associated with Met Signal, and we'll take a closer look on the next slide.

Met Signal Adaptable Parameters

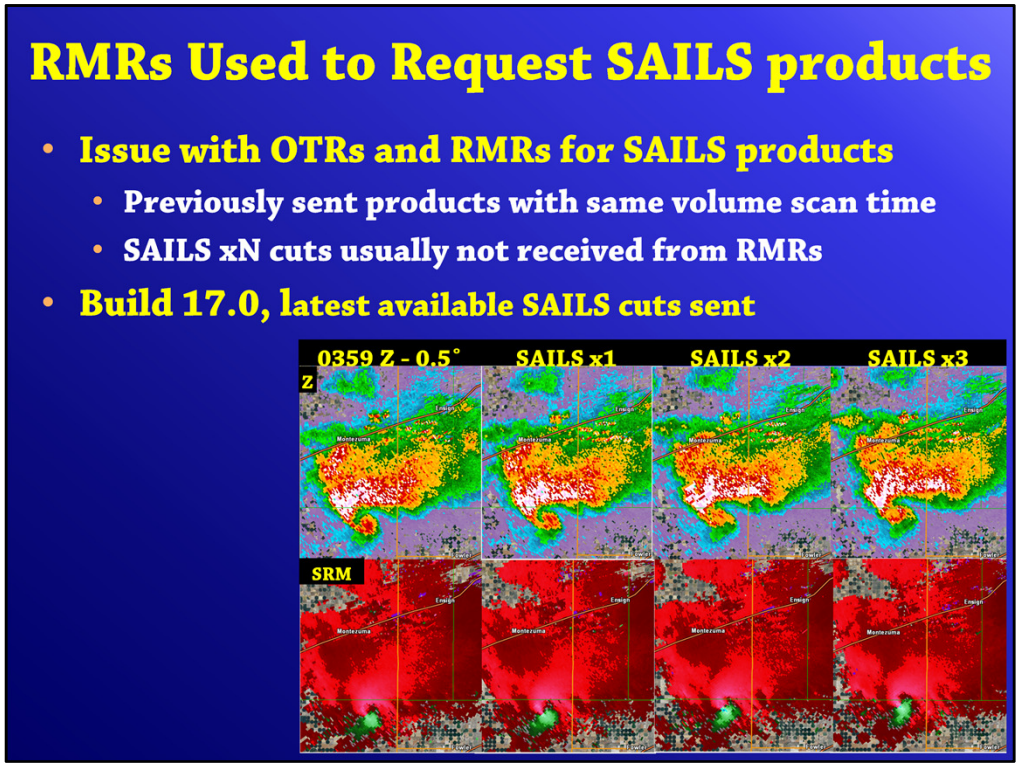
- **ROC guidance: "set it and forget it"**
  - **Will be evaluated and guidance may change**
- **Expected to better support prevention of QPE contamination from wind turbines**
  - **Use Met Signal instead of Exclusion Zones**
  - **More on this later…**



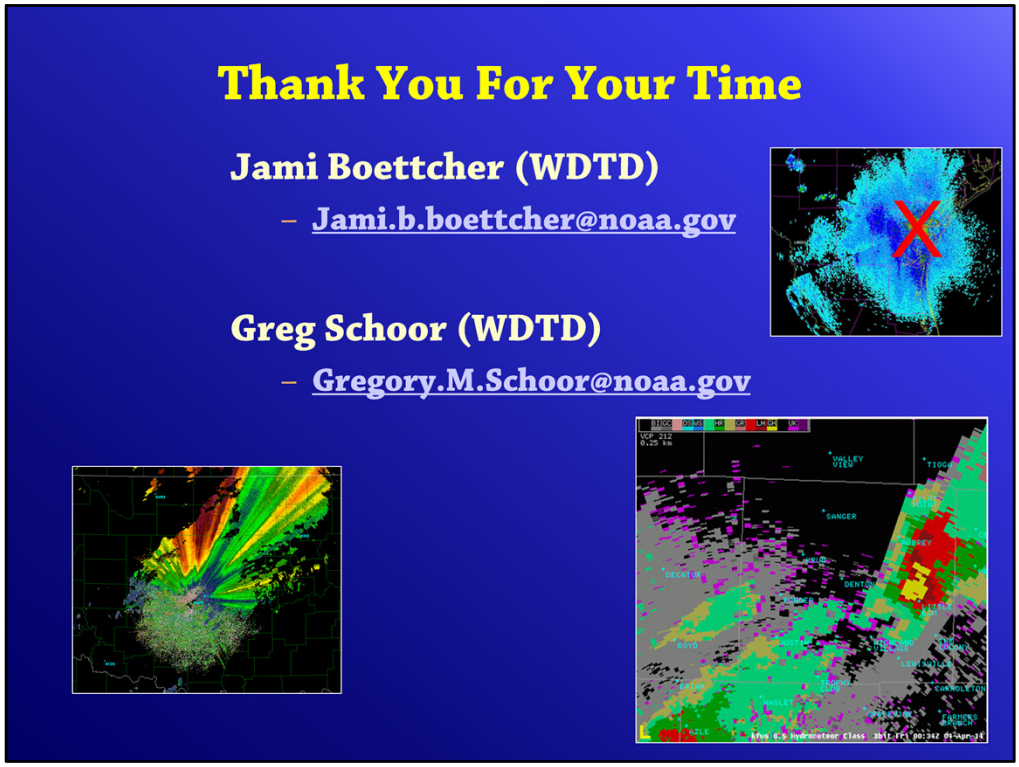
Here's a closer look at the five Met Signal parameters and their current default settings. The ROC guidance as of this writing is to "set it and forget it". Over time, the performance will be evaluated and the guidance may change. The anticipated benefit, is an improvement in the identification of contamination from wind turbines such that QPE Exclusion Zones will not be needed for areas of wind farms. Met Signal is only going to affect the Dual-Pol base and derived products. It is not a filter at the RDA, affecting all of the base data. Finding a unique signal for wind turbine-generated clutter remains an elusive problem.



A couple more important notes for this update and this first one is for the "dBZ0" values for both the Horizontal and Vertical Channels. As of Build 17.0, they will be displayed on the front page of the RPG HCI. There is no perfect value, and these numbers will vary from site to site. The status bar will remain green unless the dBZ0 values exceed ±2 dB. In that case, the status bar background will change to yellow.



Finally, Build 17.0 provides an update that allows for SAILS cut products to be available via One Time Requests (OTRs) or Radar Multiple Requests (RMRs). Previously, the software was designed to send products with the same volume scan time. With Build 17.0, a request of “all 0.5° products” includes the appropriate number of 0.5 products, since the SAILS option is known. For example, if SAILSx3 is active, the “all 0.5° products” request will be honored with the last four 0.5° products, ensuring that the latest SAILS cut products are sent.



There were a lot of short content but important updates and additions in this particular build, so if you have any questions or comments, please contact either or both of us. And thank you for your time!