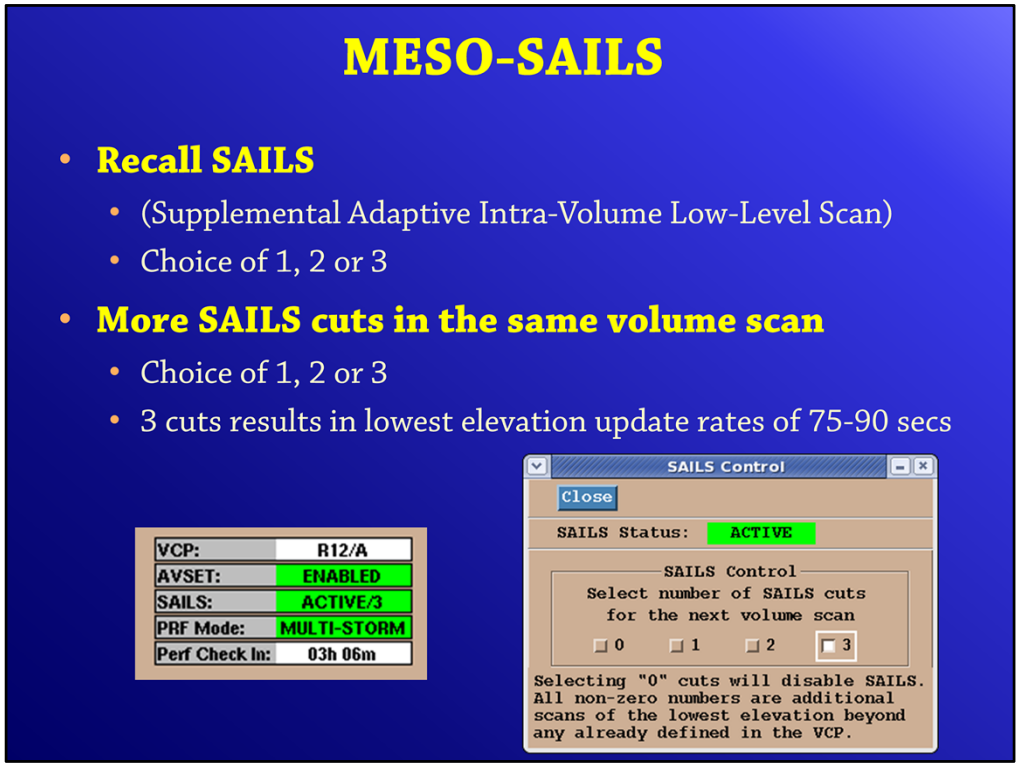
Welcome to the RDA/RPG Build 16.1 Training, presented to you by Jami Boettcher and Greg Schoor of the Warning Decision Training Division. Though the “point one” means this is an intermediate build release, there are two important operational updates, so stay tuned!

The implementation of SAILS for VCPs 12 and 212 has been highly successful, and the first update of interest is the fleet-wide implementation of MESO–SAILS. In case you've forgotten, SAILS stands for Supplemental Adaptive Intra-Volume Low-Level Scan.

The "MESO" in MESO–SAILS does ***not*** stand for mesoscale or mesocyclone. MESO stands for Multiple Elevation Scan Option. MESO-SAILS is an expansion of the ability of SAILS to provide the option of 1, 2, or 3 SAILS cuts during a volume scan. For example, if you're running MESO-SAILS with 3 cuts selected, you get 4 (yes ***four!***) 0.5° cuts in one volume. With the volume scan update rates for 12 and 212, you will see the lowest elevation products at intervals of a little over 1 minute. MESO-SAILS remains an option only for VCPs 12 and 212.

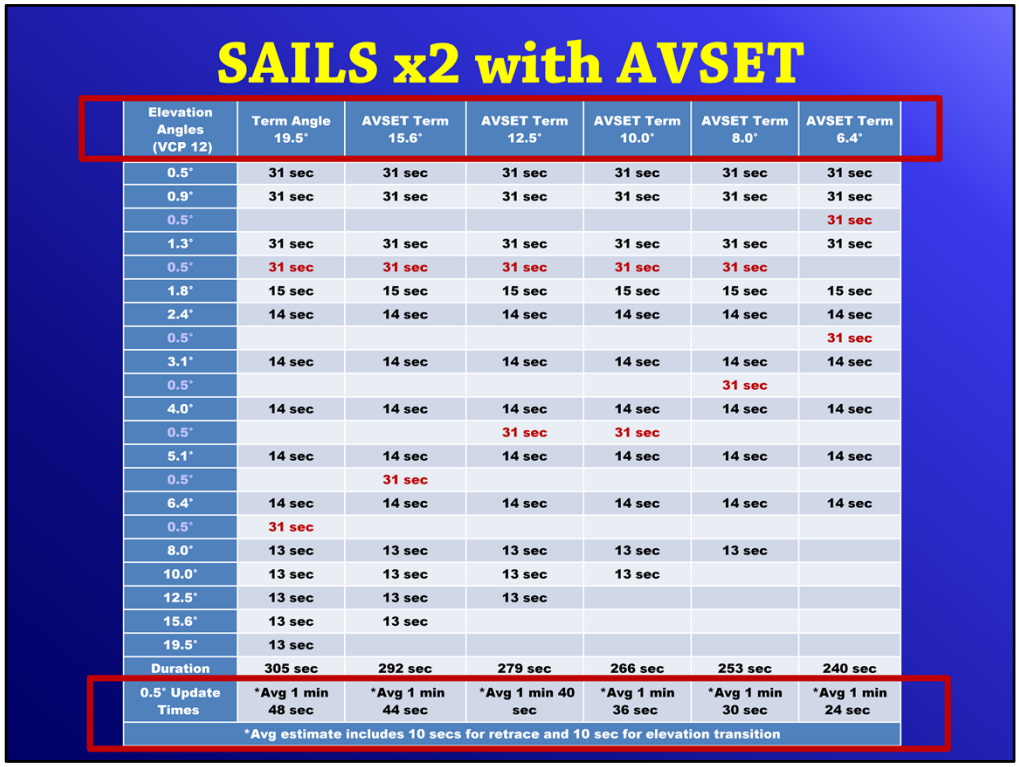
The second update of interest is the addition of the Raw Correlation Coefficient product. This is ***not*** a Super-Res version of CC. It is the unprocessed Level II data, hence the title "Raw". As a reminder, the CC that you're used to has been smoothed and recombined from 0.5° to 1° azimuthal resolution. It is a Level III product.

It is recommended that you review the RDA/RPG Build 16.0 training, which was released Summer 2015 and is available by clicking on this link. You can also go to the LMS, take the brief module for credit. This will help give a more complete picture of this latest build release and prepare you for future builds and the enhancements they offer.



One of the reasons to review the Build 16.0 training is to have a good understanding of SAILS, so that you can build on that knowledge with MESO-SAILS, which is the next generation ability of SAILS. Recall that SAILS adds an extra 0.5° cut in the "middle" of VCP 12 or 212, and the "middle" is based on time, not elevation. The addition of even one extra 0.5° cut (SAILS x1) has a significant benefit for monitoring the evolution and motion of a significant feature.

With MESO-SAILS, that benefit is enhanced with the choice of 1, 2 or 3 additional 0.5° cuts. The choice of 2 cuts results in a 0.5° update rate of 1 minute 24 seconds to 1 minute 48 seconds. The choice of 3 cuts results in a 0.5° update rate of 75 to 90 seconds. Why the variation? You'll see details on the next two slides.



Elevation Angles (VCP 12)	Term Angle 19.5°	AVSET Term 15.6°	AVSET Term 12.5°	AVSET Term 10.0°	AVSET Term 8.0°	AVSET Term 6.4°
0.5°	31 sec	31 sec	31 sec	31 sec	31 sec	31 sec
0.9°	31 sec	31 sec	31 sec	31 sec	31 sec	31 sec
0.5°						31 sec
1.3°	31 sec	31 sec	31 sec	31 sec	31 sec	31 sec
0.5°	31 sec	31 sec	31 sec	31 sec	31 sec	
1.8°	15 sec	15 sec	15 sec	15 sec	15 sec	15 sec
2.4°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°						31 sec
3.1°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°					31 sec	
4.0°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°			31 sec	31 sec		
5.1°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°		31 sec				
6.4°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°	31 sec					
8.0°	13 sec	13 sec	13 sec	13 sec	13 sec	
10.0°	13 sec	13 sec	13 sec	13 sec		
12.5°	13 sec	13 sec	13 sec			
15.6°	13 sec	13 sec				
19.5°	13 sec					
Duration	305 sec	292 sec	279 sec	266 sec	253 sec	240 sec
0.5° Update Times	*Avg 1 min 48 sec	*Avg 1 min 44 sec	*Avg 1 min 40 sec	*Avg 1 min 36 sec	*Avg 1 min 30 sec	*Avg 1 min 24 sec
*Avg estimate includes 10 secs for retrace and 10 sec for elevation transition						

There are a lot of details here, but it's worth it. This table depicts the interaction of AVSET (Automated Volume Scan Evaluation and Termination) and MESO-SAILS with two 0.5° cuts selected, which is denoted as SAILS x2. The specific insertions for the 2 SAILS cuts are shown, as well as how the update times are dependent on the termination angle determined by AVSET. Notice that as the AVSET termination angles get lower (from left to right on the table), the insertions for the SAILS cuts changes and the time between 0.5° updates decreases. With AVSET off or terminating at 19.5°, the volume will take just over 5 minutes to complete, but you also get two additional 0.5° cuts during that volume.

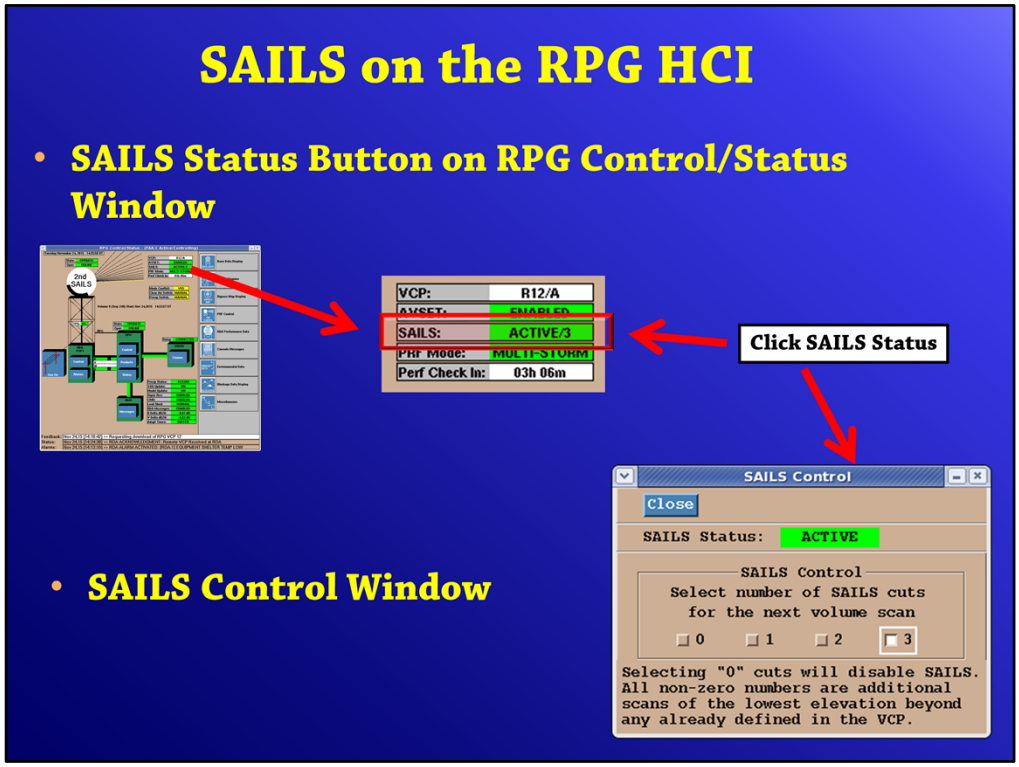
SAILS x3 with AVSET

Elevation Angles (VCP 12)	Term Angle 19.5	AVSET Term 15.6°	AVSET Term 12.5°	AVSET Term 10.0°	AVSET Term 8.0°	AVSET Term 6.4°
0.5°	31 sec	31 sec	31 sec	31 sec	31 sec	31 sec
0.9°	31 sec	31 sec	31 sec	31 sec	31 sec	31 sec
0.5°			31 sec	31 sec	31 sec	31 sec
1.3°	31 sec	31 sec	31 sec	31 sec	31 sec	31 sec
0.5°	31 sec	31 sec				
1.8°	15 sec	15 sec	15 sec	15 sec	15 sec	15 sec
0.5°			31 sec	31 sec	31 sec	31 sec
2.4°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
3.1°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°		31 sec				31 sec
4.0°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°	31 sec				31 sec	
5.1°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°			31 sec	31 sec		
6.4°	14 sec	14 sec	14 sec	14 sec	14 sec	14 sec
0.5°		31 sec				
8.0°	13 sec	13 sec	13 sec	13 sec	13 sec	
0.5°	31 sec					
10.0°	13 sec	13 sec	13 sec	13 sec		
12.5°	13 sec	13 sec	13 sec			
15.6°	13 sec	13 sec				
19.5°	13 sec					
Duration	336 sec	323 sec	310 sec	297 sec	284 sec	271 sec
0.5° Update Times	*Avg 1 min 29 sec	*Avg 1 min 26 sec	*Avg 1 min 23 sec	*Avg 1 min 19 sec	*Avg 1 min 16 sec	*Avg 1 min 13 sec

*Avg estimate includes 10 secs for retrace and 10 secs for elevation transition

With SAILS x3 enabled, you'll be adding about 30 seconds to most of these columns, but getting near one-minute 0.5° cuts. It just depends on what your scanning needs are. This is always a trade off: are you looking for core heights in the higher tilts for warning decisions or are you trying to see low-level circulation evolution? Maybe it's both, in which case, you could either use SAILS x1, giving you one additional 0.5° cut in the middle of the volume, or SAILS x2, giving you 2 additional 0.5° cuts.

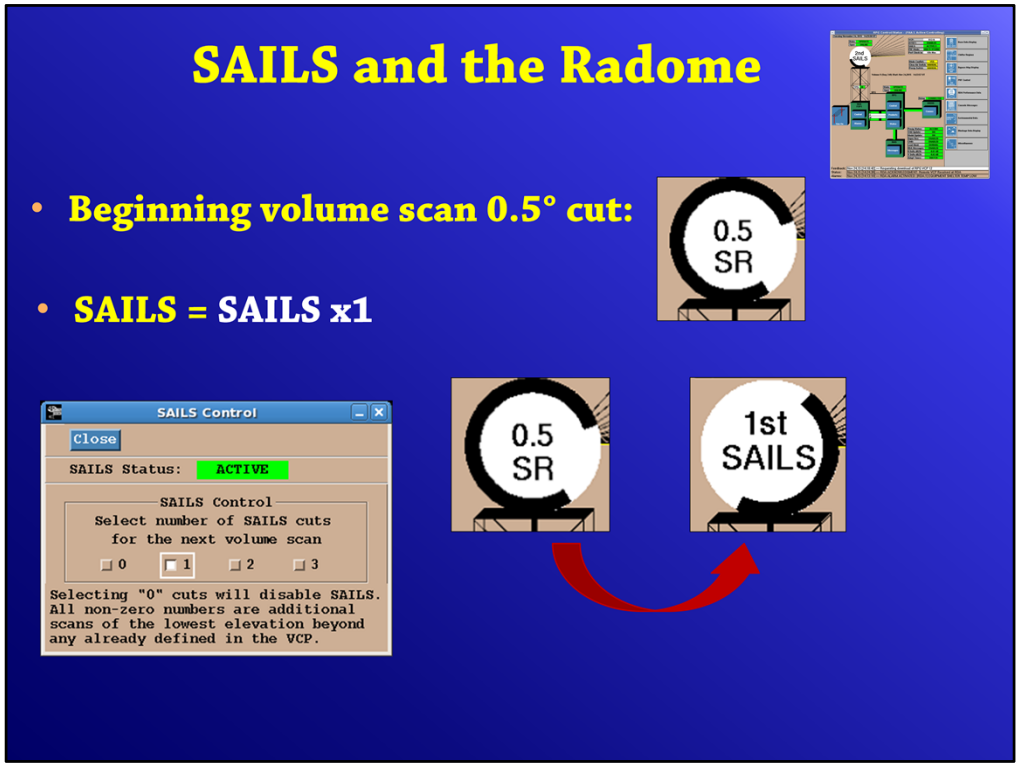
New scanning strategies are being worked on at the Radar Operations Center (ROC), to allow for SAILS-like options for the lowest few tilts, not just 0.5° – so stay tuned!



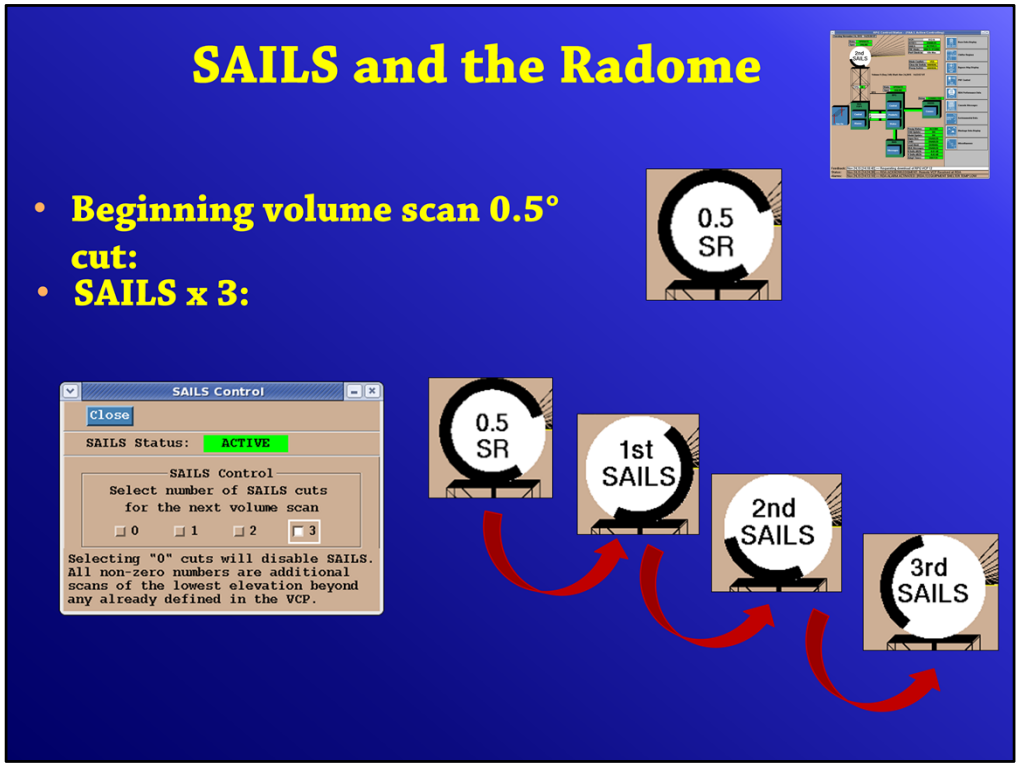
How do you invoke the number of SAILS cuts desired? Starting on the RPG Control/Status Window, the SAILS Status button tells you the current setting. In this example, it is SAILS x3, and since we're in VCP 12, SAILS is ACTIVE.

Click on the SAILS Status button and the SAILS Control Window appears. This window allows you to select the number of SAILS cuts you desire.

Selecting "0" disables SAILS, so you get no SAILS cuts. "1" is what you may be used to as just "SAILS", giving you one additional 0.5° cut in the middle of the volume scan. Selecting 2 or 3, falls under the category of "MESO-SAILS", though you won't find this term anywhere in these windows. In this case, all 3 SAILS cuts has been selected, and we'll call it SAILS x3.



With both SAILS and AVSET active, there is a need to know when the SAILS cut is executed. To support this, two changes have been made to the radome on the RPG Control/Status Window. At the beginning of the volume scan, the radome displays 0.5° and SR (as before). In this example, SAILS x1 has been selected. When the SAILS cut is executed, "1st SAILS" appears on the radome.

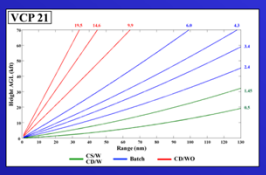


With MESO-SAILS and AVSET active, that need to know is also satisfied by updates on the radome. At the beginning of the volume scan, the radome displays 0.5° and SR (as before). The subsequent SAILS cuts are identified as 1st, 2nd, or 3rd, depending on whether 2 or 3 cuts has been selected. Here we have an example of each of the SAILS cuts on the radome when SAILS x3 has been selected.

MESO-SAILS Considerations

- **With SAILS x N:**
  - **Rotation speeds and elevation changes well within design and performance specs**

- **SAILS x N will *not* cause excessive wear and tear**
  - ***All* accelerations (up or down) for SAILS cuts similar to routine VCP 21 movement**
    - **~1/3 of NEXRAD spec (36°/sec²)**

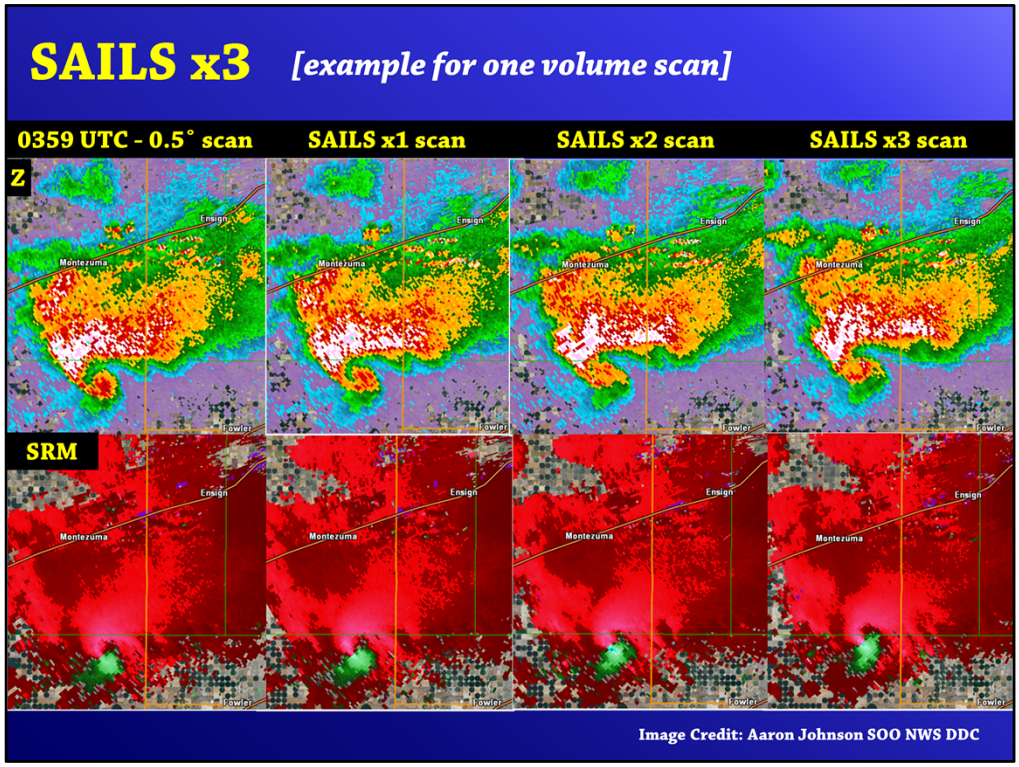


- **All Tilts issue with SAILS products fixed in AWIPS-2 OB 16.1.1**
  - **(AWIPS & NEXRAD with same build numbers!)**

With the faster VCPs 12 and 212, plus the additional SAILS cuts, there may be concern about antenna assembly wear and tear. ROC Engineering has been involved in the design and testing of both SAILS and MESO-SAILS, and there are no concerns from these experts about additional wear and tear. In fact, SAILS uses the ***same*** azimuthal rotation rates as VCPs 12 and 212. It is interesting to note that the antenna accelerations and decelerations to achieve the SAILS cuts are comparable to (and often lower than) the rates used by VCP 21. The greatest rate for VCP 21 is a deceleration of 11.25°/sec^2 and the greatest rate for SAILSx3 is a deceleration of 12.59°/sec^2. What really matters here is that the NEXRAD design spec for ***both*** acceleration and deceleration is 36°/sec^2, and the antenna motions for both VCP 21 and MESO-SAILS are at most ***one third*** of that design spec! VCP 21 has been with us since the original deployment and these acceleration/deceleration rates have proven to be well tolerated.

The SAILS x3 function has been under constant test at the ROC for over a year and for the last 6 months at 13 Field Test sites. These improvements to radar performance would not be fielded without complete support from the engineering experts at the ROC.

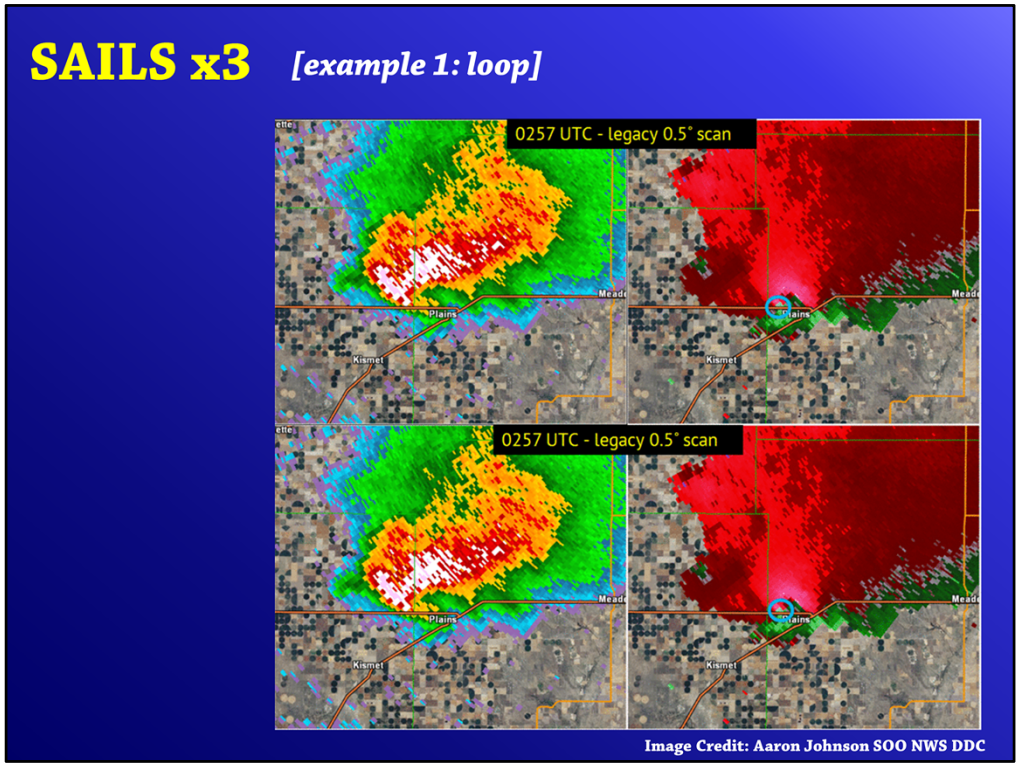
Finally, the ALL-TILTS issue that has been identified in AWIPS-2 has a fix that will be released with Operational Build 16.1.1. Interesting that the build numbers coincide.



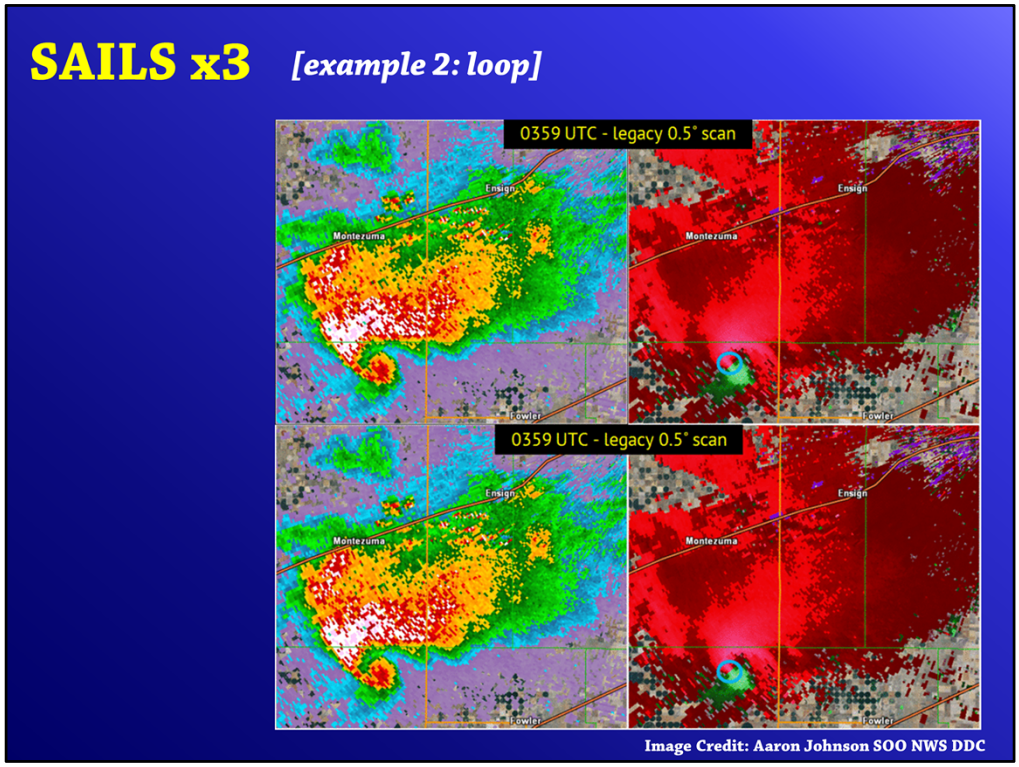
Thank you, Jami! This is Greg Schoor, Instructor tag-teaming with Jami and I'll finish up the lesson with some examples of just how beneficial MESO-SAILS can be in certain situations. MESO-SAILS is great for low-level features, especially cyclic supercells, but it obviously won't be a go-to option for every type of convective event – so keep that in mind as we go through these examples.

What does it look like to receive nearly one-minute updates of the lowest-degree tilt in real-time? For those with local TDWR feeds, the benefits are familiar, and MESO-SAILS provides that benefit with NEXRAD data quality. In this example, provided by Aaron Johnson, SOO at the WFO in Dodge City, KS there is clear evolution in the low levels of this tornadic supercell during just this one volume scan. For the 03:59 UTC volume, with no SAILS or MESO-SAILS capability, you would have only received the left-most images and then had to wait 4 to 5 minutes for the next scan (depending on AVSET).

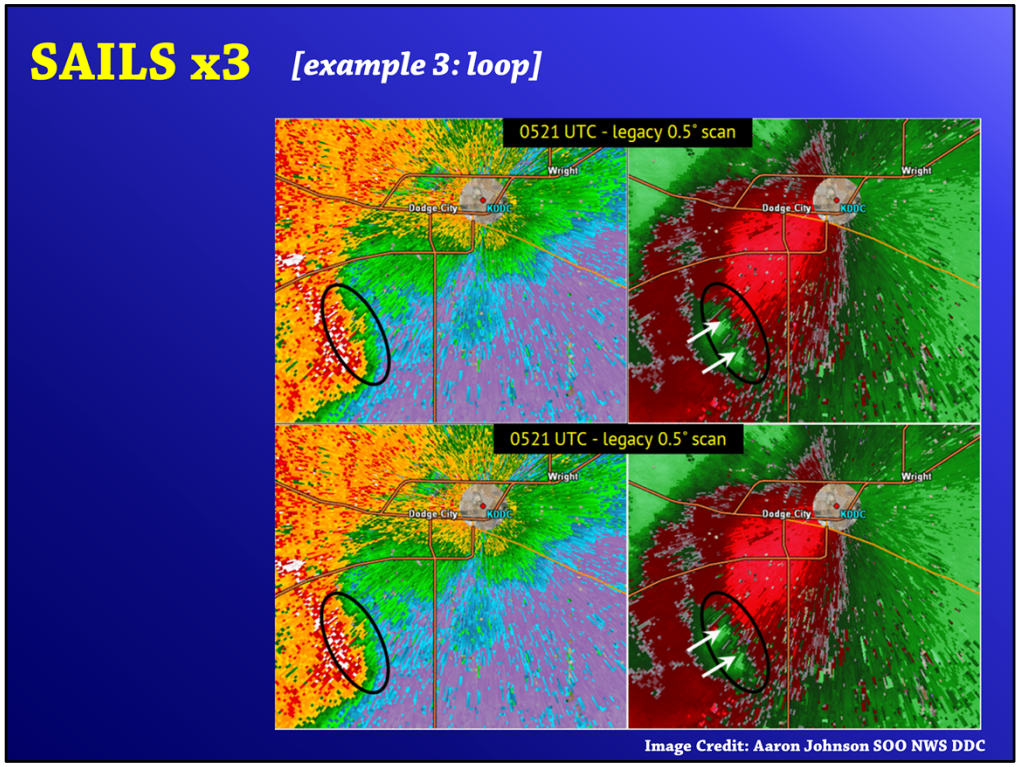
With SAILS enabled, you would get **one** additional 0.5° degree cut for each volume, which in this series of images would be the image pair under the third column (labeled SAILS x2), since it would fall roughly in the middle of the volume…time-wise. And the correct designation would be SAILS x1. But in this series of images SAILS x3 is enabled, so you not only get that additional middle of the scan, but two others as well, one on either side, which are all about one-minute apart. So, imagine watching a feature such as a downburst, or hook echo, or a QLCS appendage in nearly minute-by-minute evolution. The next few slides will show you just that, with loops of evolving low level signatures.



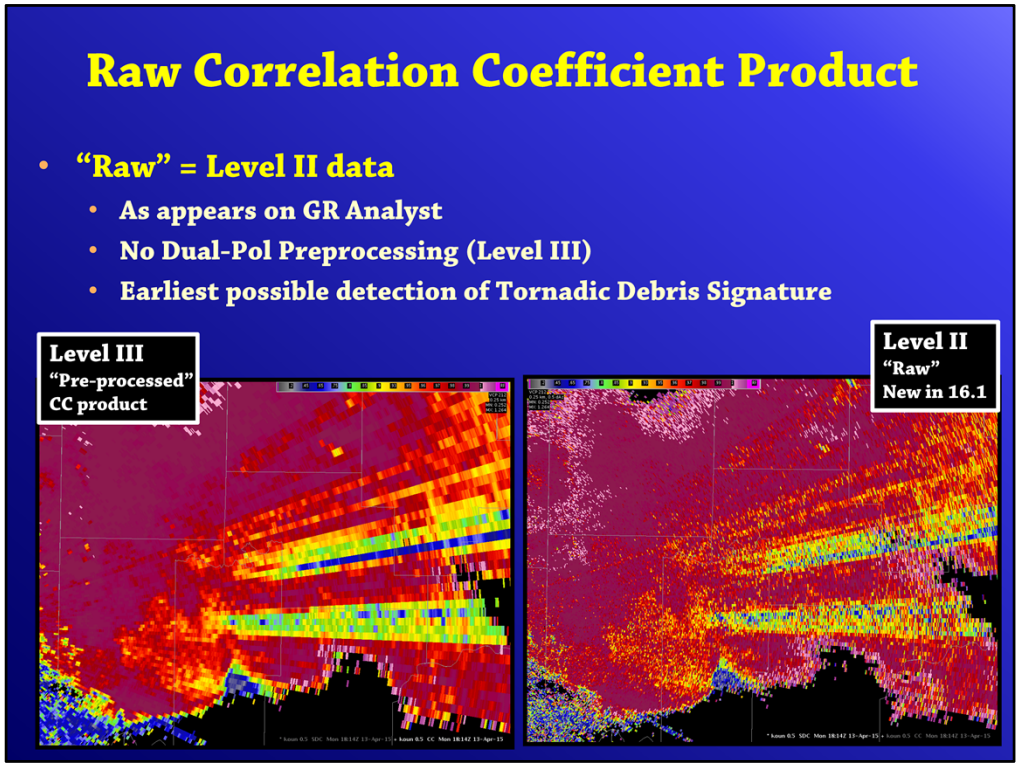
This is the first of 3 examples that are all short gif animations, that will keep replaying from start to finish. All images were provided by Aaron Johnson, SOO at NWS Dodge City, KS and all were from a severe weather event in late May of 2015. All examples have SAILS x3 enabled, so we're getting the maximum amount of 0.5° cuts per volume with this setting. Reflectivity will be on the left and SRM on the right. The top half of these loops are the SAILS x3 cuts and the bottom half show just the first 0.5° cut from each consecutive volume. You'll notice that while the bottom half images are basically "standing still", in terms of time, the top half move consistently through scans that are coming in at intervals of just over one minute! Notice how the estimated track of the mesocyclone, added by Aaron, shows a more detailed and refined track then the legacy side which looks like it's just connecting the dots with much lower spatial accuracy.



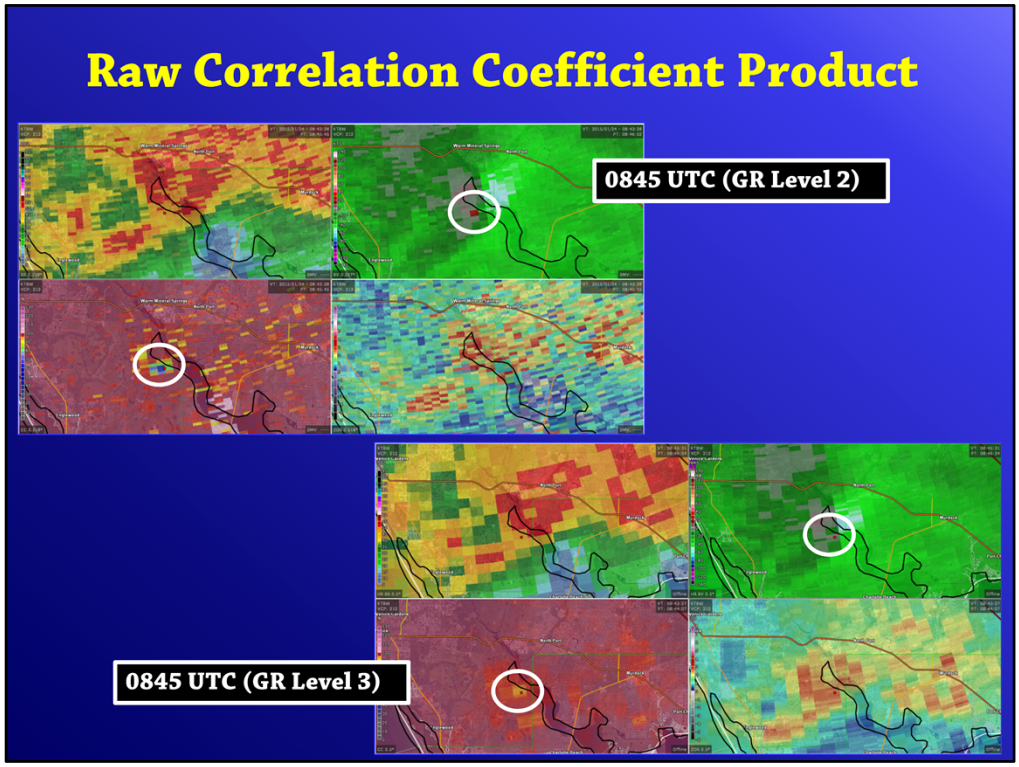
We'll follow this trend into the second example, which again, shows the tracks of multiple possible mesocyclones. Not only are we able to better track a more exact path of a potential tornado or at least the best area of rotational velocities, but we now have a bit more lead time on the precursors of these types of signals. As you watch the second couplet that doesn't quite develop and the third one that does. The second, which may have been a brief satellite tornado, wasn't even detected with the legacy scan timing.



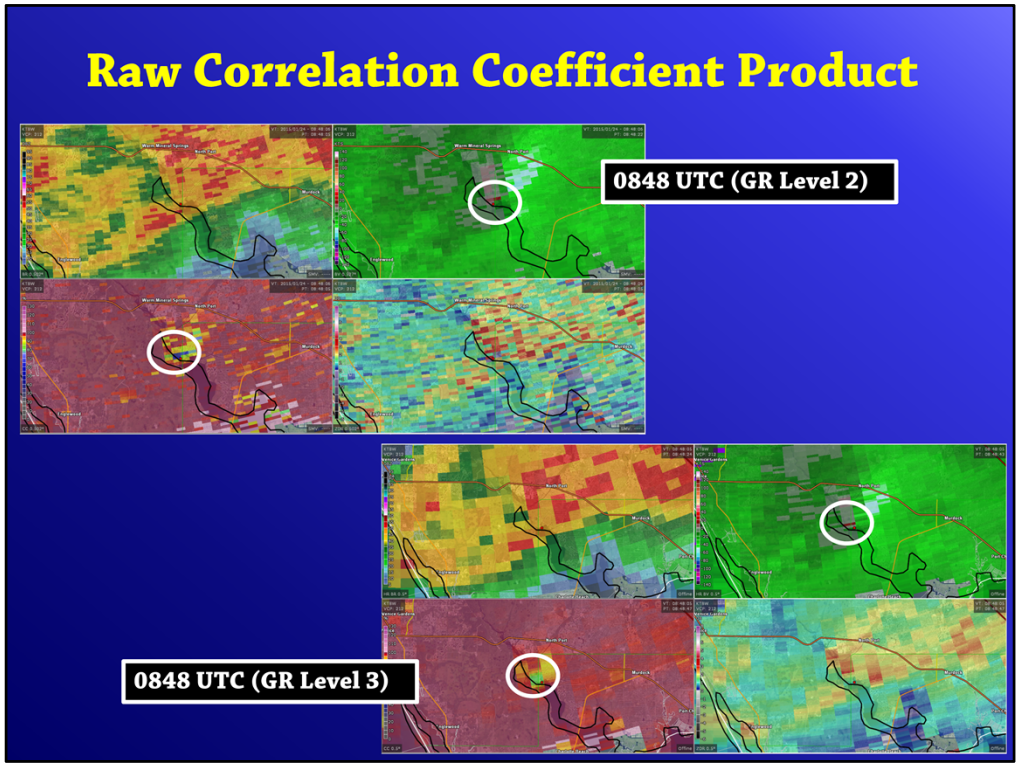
And the last example is from a close call of an RFD surge that swept just south of Dodge City, KS – just a few miles away from the RDA. You can see some brief and embedded couplets with this surge and again, notice the differences in the evolution of this feature with SAILS x3 enabled and compare it to the legacy scan timing on the bottom. With a feature like this so close to the radar, you're probably not getting very good upper level tilts anyway. It may be of more benefit to have SAILS x3 running in cases like this, so you can track the low-level progression of such features. If you are more concerned about a core height, you may not have good sampling of the upper tilts of the storm or the core aloft anyway and may have to utilize another nearby radar for that. All of this is a balancing act, where you need to determine, sometimes in real-time with split-second decisions, which option is the best for that moment for the features you have on the radar.



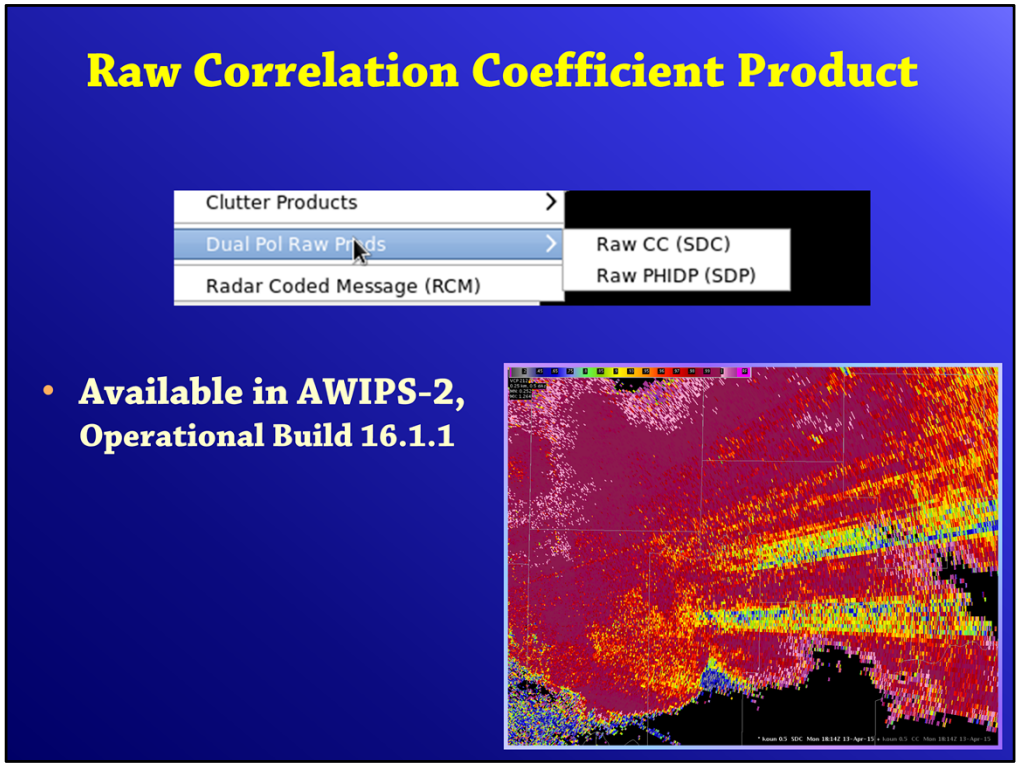
The second significant update with RDA/RPG Build 16.1 is the addition of the Raw Correlation Coefficient (CC) Product. This product has been added to RPG product suite at the request of numerous WFOs, particularly in the southeastern U.S. Comparisons of the Level II, Raw, CC data on GR Analyst with the Level III CC product on AWIPS during warning operations has shown that Tornadic Debris Signatures (TDS) are easier to see in the Level II data. This is of particular important where tornadoes can spin up along squall lines, and/or occur at night, conditions more likely in the southeastern U.S. Getting a Raw CC product into the AWIPS baseline supports the earliest possible detection of a TDS. The example images on the bottom, show the Level III data, on the left, is actually Pre-Processed and what you're used to seeing on AWIPS, while the Level II CC on the right, looks like it has finer detail, only because it is not Pre-Processed, which is why it is considered "Raw".



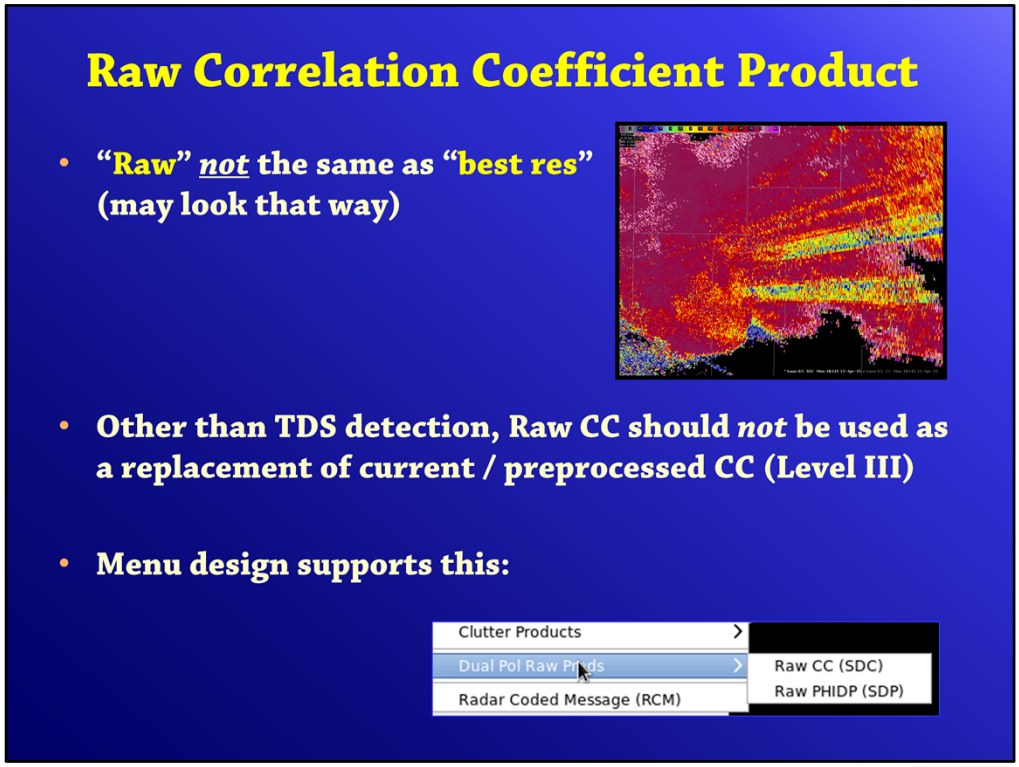
Here is an example at 08:45 UTC (definitely overnight), which is overnight and both of these example images are at the same time. The Level II four panel is on the upper left, with a corresponding Level III four panel on the lower right. Note that in both images there is a local minimum in CC collocated with the small velocity couplet. However, the CC minimum in the Level II image, compared to the minimum in the Level III image, is more visually apparent, and the minimum itself is lower. It looks more like a TDS in the Level II image than in the Level III image.



Stepping forward to the next volume scan, the visual difference between the Level II and the Level III CC images is still apparent. Switch back and forth between this slide and the previous one, if you want to get a sense of this progression – then move to the next slide, when you're ready.

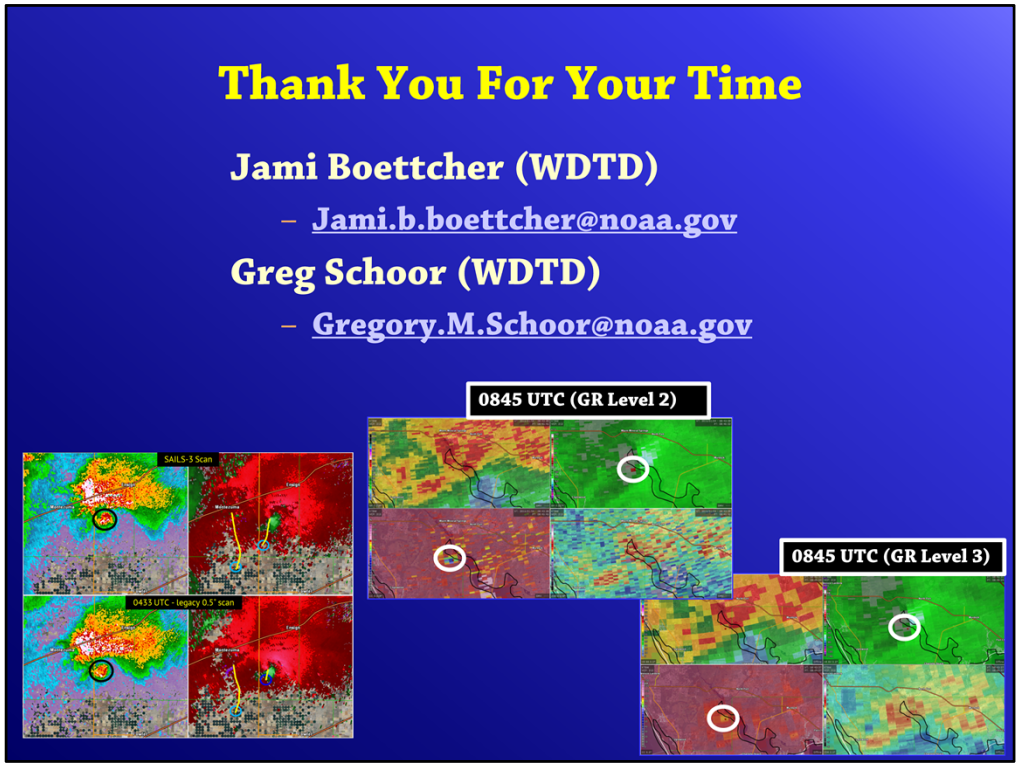


The Level II CC Product viewable in AWIPS is identified as the Raw CC (SDC). It will be available with AWIPS-2 Operational Build 16.1.1. You may notice a menu entry for “Raw PhiDP (SDP)” just below it. That will become available with RDA/RPG Build 17.0, with the deployment currently scheduled to begin during the Fall of 2016 and there will definitely be training on that product!



It is important to remember that "Raw" for CC does ***not*** mean the same thing as best res or Super-Res for a product like reflectivity. The legacy base data (Z, V, and SW) are less noisy than the Dual Pol base data, and can be interpreted with 0.5° azimuthal resolution. Recall that the Dual Pol base data, which arrives from the RDA at 0.5° azimuthal resolution, are Preprocessed at the RPG before any of the Dual Pol products are generated. Preprocessing recombines the 0.5° azimuth to 1.0° azimuth, and smooths the Dual Pol base data. In some cases, details in a small TDS can be less apparent due to the Preprocessing algorithm.

The Raw CC is ***just*** the CC base data from the RDA generated as a product. Other than TDS detection, the Raw CC should not be your new "go-to" CC. For all other applications, the Level III, Preprocessed CC is still superior (think winter weather, hail, etc.). The design of menu supports this as well, keeping the Raw CC product in a menu stream separate from the Level III CC product.



So, that's it. There is no completion quiz for this module. Thank you for your time and if you have any questions, feel free to direct them to either or both of us!