WACR-ARSCL: Current Status and Future Plans

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About the W-Band Cloud Radar:

1. The W-Band (95 GHz) cloud radar (WACR) is operated by ARM primarily at the mobile facilities.

2. The purpose of this instrument is to examine the extent and composition of clouds.

3. A version of the Active Remote Sensing of Clouds (ARSCL) value-added product (VAP) has been developed for the WACR.

4. Collocation of micropulse lidars and ceilometers during AMF deployments make this VAP possible.

5. The WACR-ARSCL product improves cloud boundaries and best-estimates of radar moments.

Poster Summary:

1. Present a status report on the reprocessing effort of the WACR-ARSCL product through the Azores AMF deployment.

2. Provide anticipated timelines for completing WACR-ARSCL processing for the MAGIC, TCAP and GoAmazon deployments.

3. Detail the clutter removal algorithm used at the Azores.

4. Describe the methodology used to adhere to the latest ARM data standards.

5. Discuss methods to expedite the placement of data into the archive.

#1: Status Report on Processing

Site	Location	Start		Finish	Archive	Final Process	Initial Process
NIM	Niamey, Niger	March 16, 2006	to	December 29, 2006	X		
FKB	Black Forest, Germany	March 29, 2006	to	January 2, 2008	X		
HFE	Shouxian, China	October 14, 2008	to	December 15, 2008	X		
GRW	Graciosa Island, Azores	July 1, 2009	to	December 31, 2010		X	
PVC	Cape Cod, Massachusetts	October 12, 2012	to	June 14, 2013			X

WACR-ARSCL Availability

Data from AMF Deployments at NIM, FKB, and HFE are in the ARM Data Archive

GRW data is available in the Evaluation Area, but is undergoing final processing and will be moved into the Data Archive by the End of the month.

With the TCAP Field Campaign having concluded, the initial processing of WACR-ARSCL has taken place shortly. These files will be placed in the Evaluation Area.

WACR-ARSCL Scheduling

TCAP FC: Initial processing has been completed. Deployment specific issues need to be addressed (e.g. Clutter) before elevation to Evaluation Area.

MAGIC FC: Need to complete ship-motion correction VAP before initial process of WACR-ARSCL. Data will be then placed in Evaluation Area.

GoAmazon FC: After data from Magic is placed in the Evaluation Area, processing of the GoAmazon data can begin. The campaign ends in December 2015, but early data will be processed and "decluttered" and placed in evaluation before then.

## #2: Anticipated Timeline for MAGIC, TCAP and GoAmazon WACR-ARSCL

	TCAP Field Campaign	MAGIC Field Campaign	GoAmazon Field Campaign
Site	TCAP	MAG	MAO
Location	Cape Cod, Massachusetts	California to Hawaii	Manacapuru, Brazil
Data Start	October 12, 2012	October 1, 2012	January 1, 2014
Data End	June 14, 2013	October 31, 2013	December 31, 2015
Initial Product	Current	May 1, 2014	June 15, 2014
Evaluation Product	May 31, 2014	July 1, 2014	December 15, 2014
Beta User Feedback	November 30, 2014	January 15, 2015	July 1, 2015
Data Archive	January 15, 2015	March 15, 2015	December 31, 2015

## #3: Clutter Removal Algorithm Used in Azores
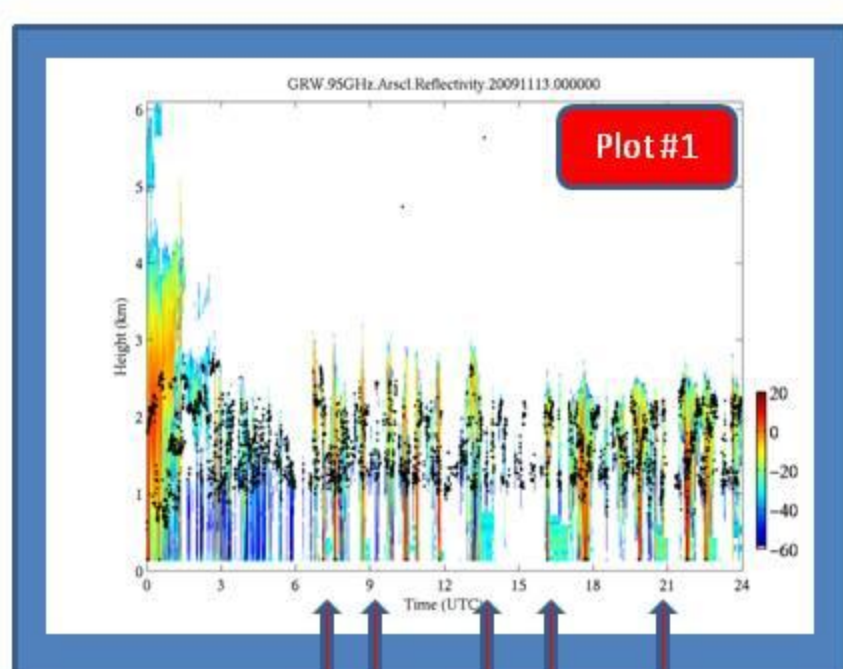
An Example of "Smearing" Artifact

- WACR-ARSCL at Azores on 11-13-2009
- Plot #1: Shows usual ARSCL Reflectivity
- Plot #2: Shows Reflectivity Best Estimate
- Plot #3: Show Modified Clutter Flag to include only removal of smeared data
- Method used to determine bad data of this type:
  - Under cloud base
  - Spectral Width < 0.20 from gates 1 to 15
  - Spectral Width < 0.10 from gates 16 to 24
  - Gate 15 is 0.80 km; Gate 24 is 1.4 km
- Virendra Ghate gave input on the spectral width
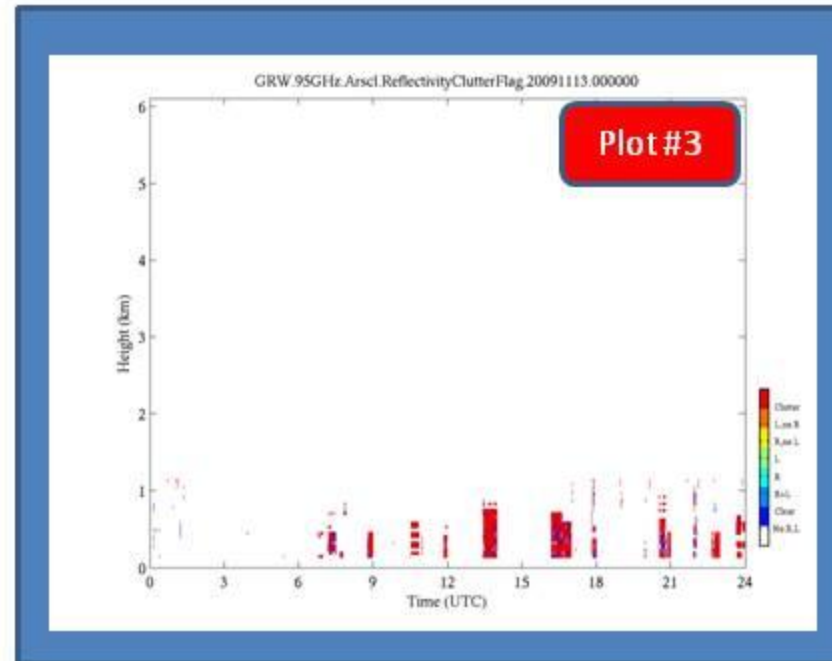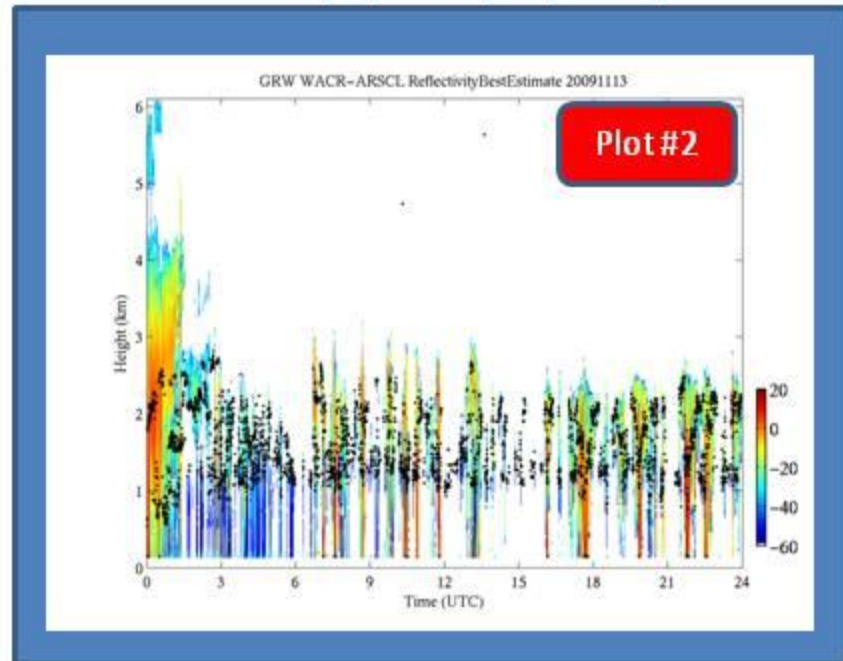
An Example of "Smearing" Artifact (con't)

- WACR-ARSCL at Azores on 11-19-2009
- Plot #4: Shows usual ARSCL Reflectivity
- Plot #5: Shows Reflectivity Best Estimate
- Plot #6: Show Modified Clutter Flag to include only removal of smeared data
- Sometimes the eliminated data exceeds what the eye tells you should be removed
- Algorithm is similar to fine tuning using multiple knobs
- Adjusting one parameter creates too many bad points in final product or too many valid points eliminated
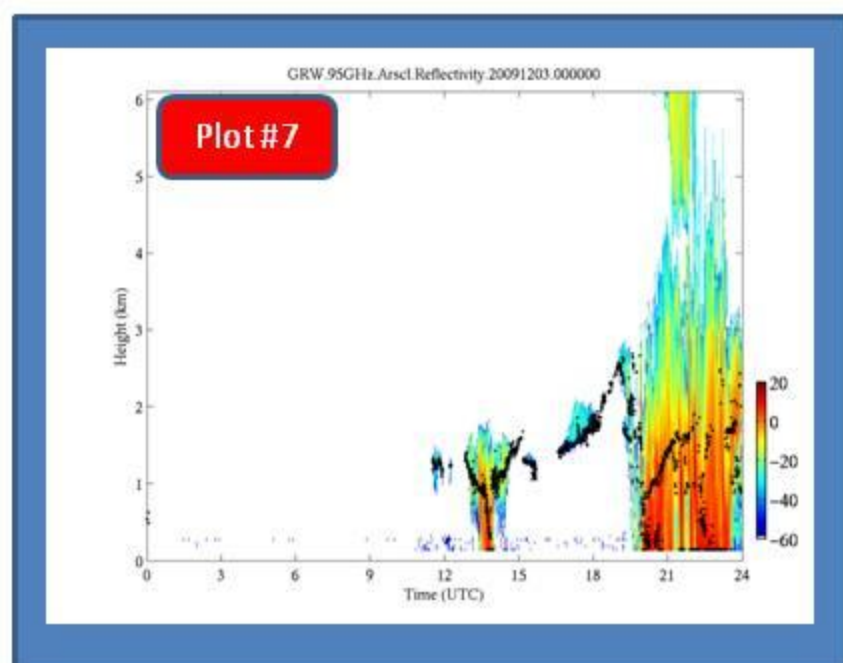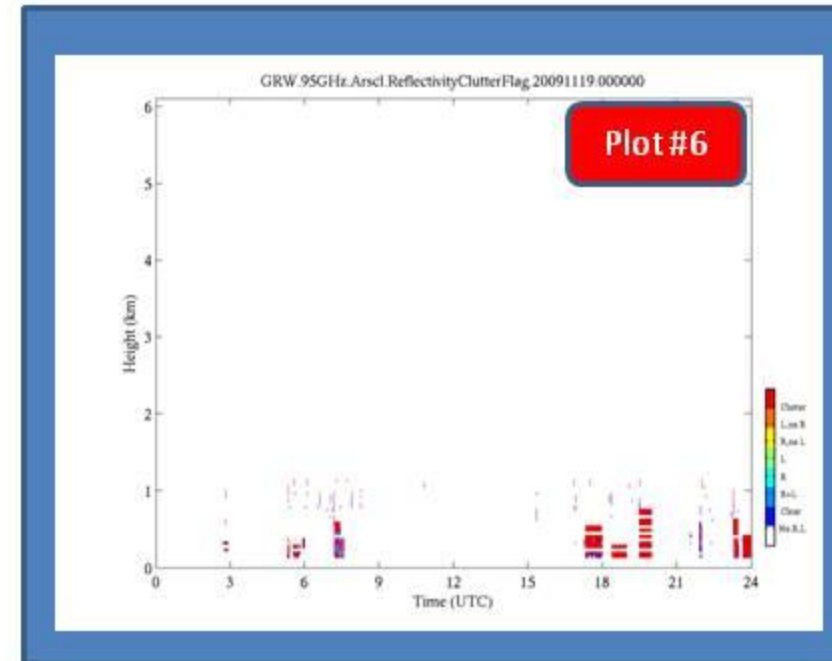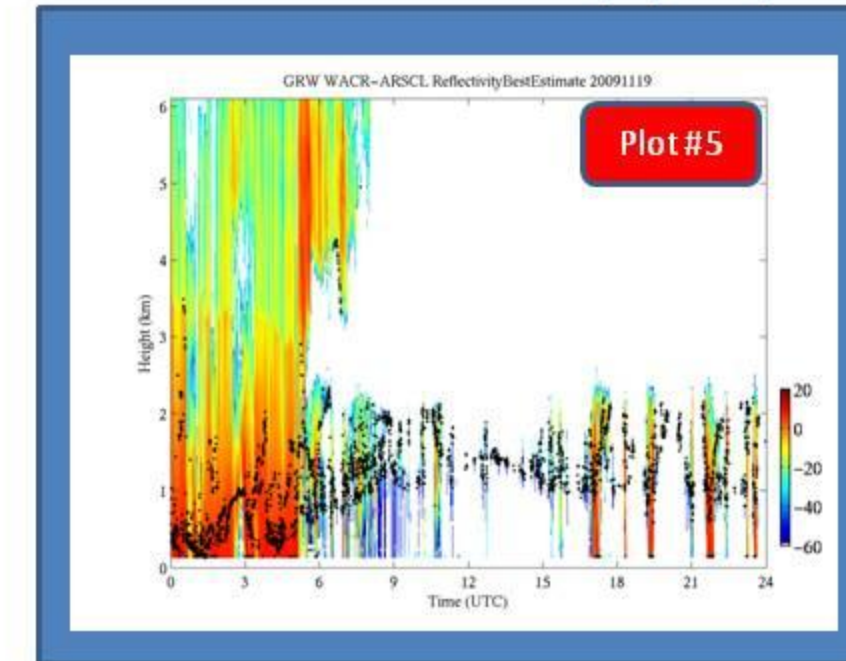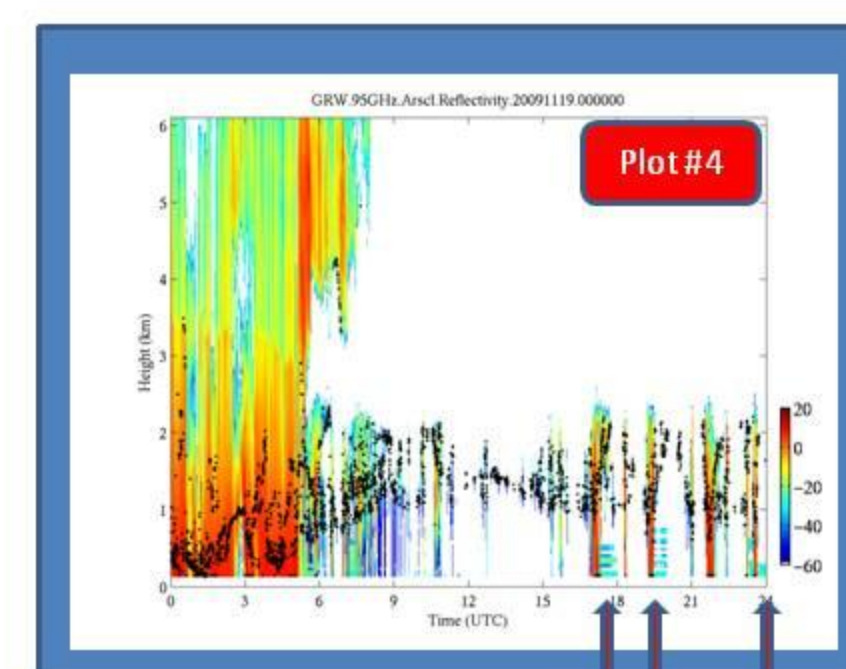
An Example of "Undercloud" Clutter Removal

- WACR-ARSCL at Azores on 12-03-2009
- Plot #7: Shows usual ARSCL Reflectivity
- Plot #8: Shows Reflectivity Best Estimate
- Plot #9: Shows Clutter Flag
- "Visual Reflectivity" – between -60 and -40 – that is surrounded by clear sky is removed.
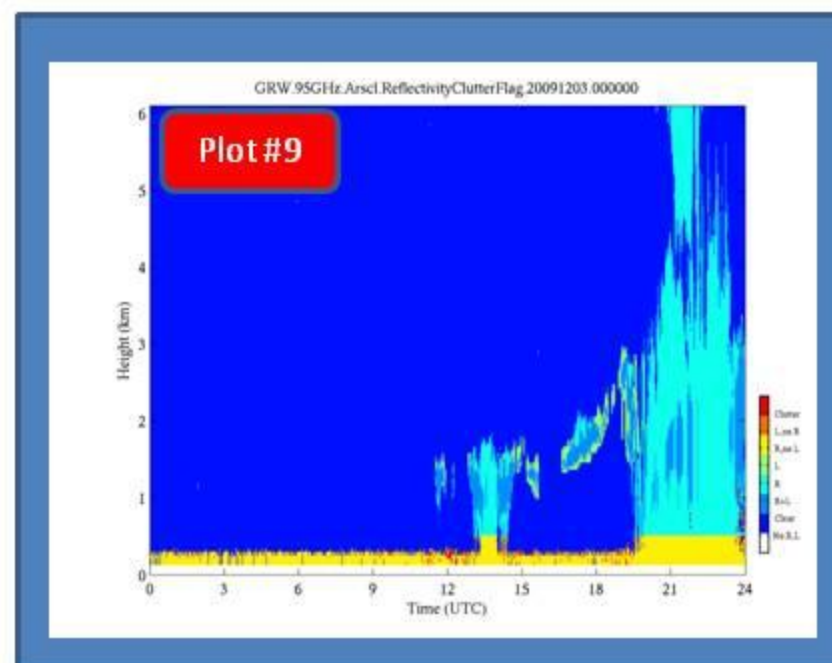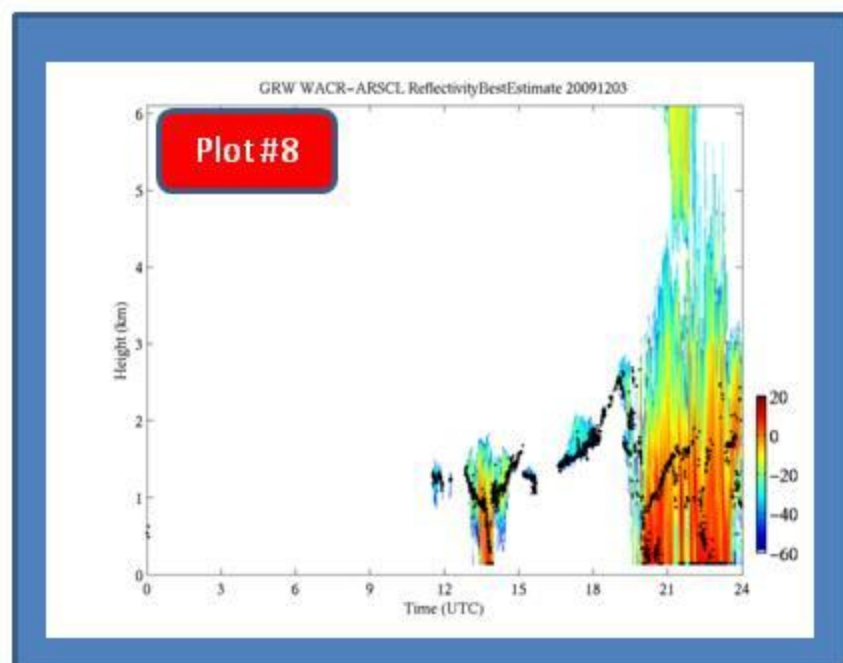
An Example of "Clear Sky" Clutter Removal

- WACR-ARSCL at Azores on 12-09-2009
- Plot #10: Shows usual ARSCL Reflectivity
- Plot #11: Shows Reflectivity Best Estimate
- Plot #12: Shows usual Clutter Flag
- Don't want to remove "cloud" that is not detected by ceilometer (i.e. ceilometer may be missing or provided bad data)
- Do want to remove all clutter otherwise detected.
- More complex algorithm that "undercloud" detection, but essentially removes same range of clutter.
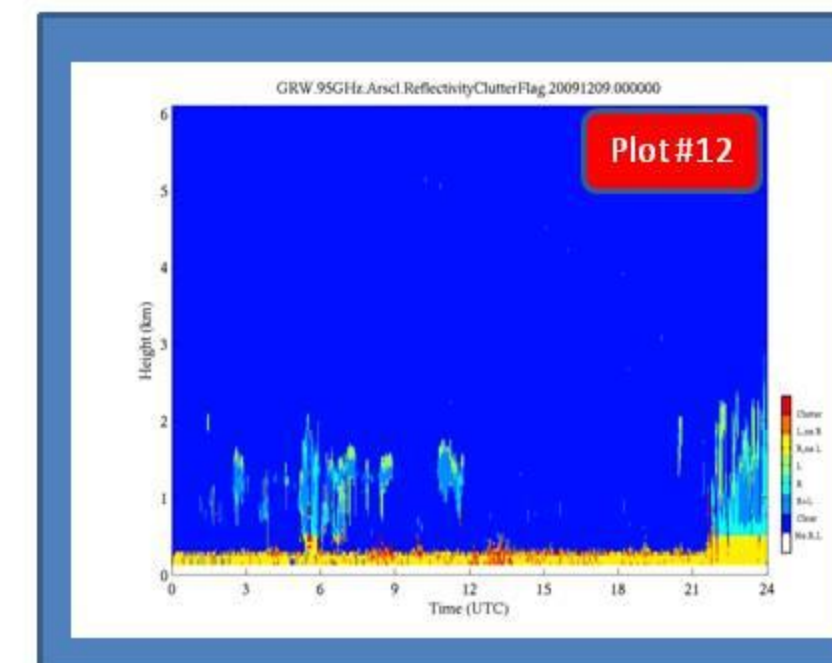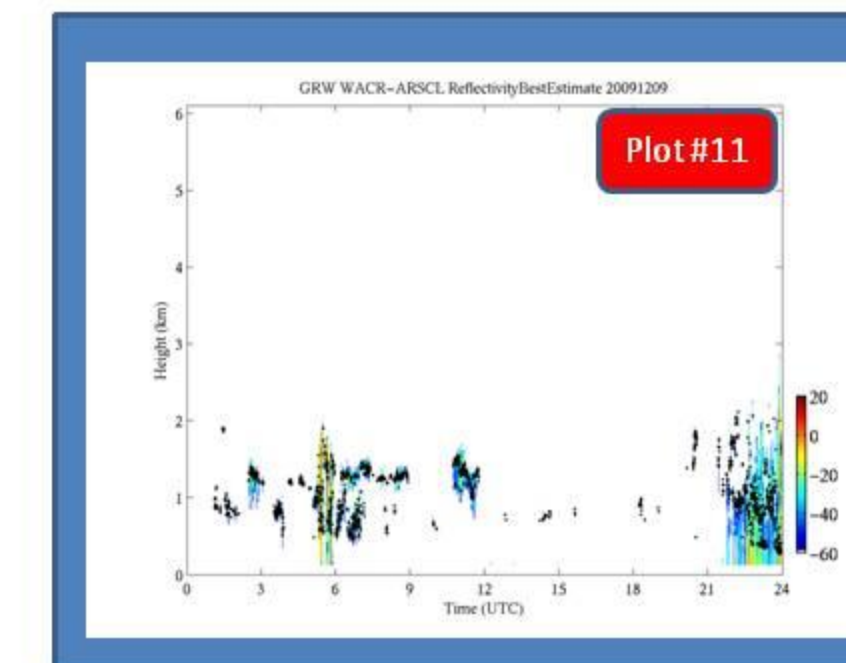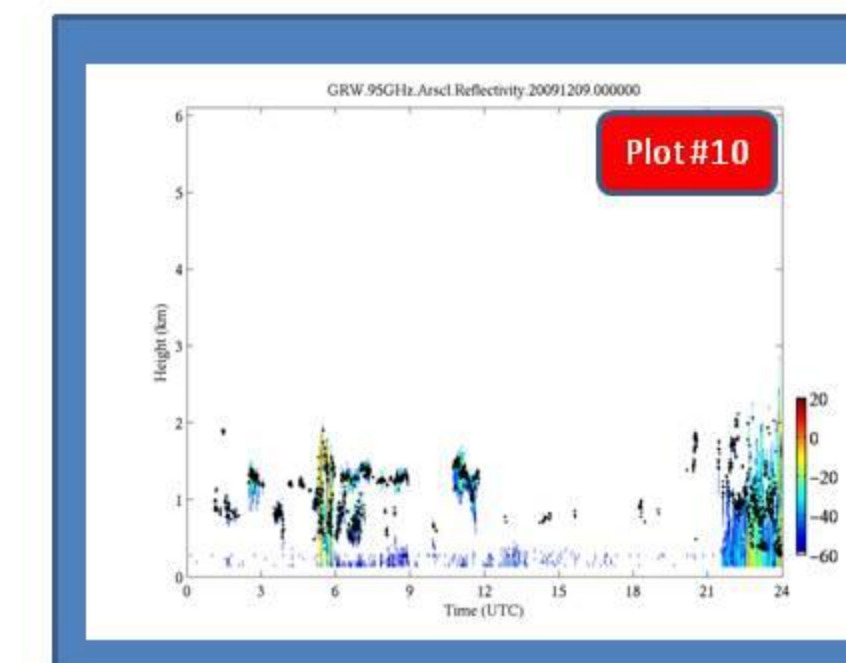
#4: ARM Data Standards

The ARM Infrastructure underwent an extensive review of the data standards used to create the ARM VAPs netCDF files. Here are some issues that required attention before WACR-ARSCL was able to be released:

1. long_name consistancy: Use "Linear depolarization ratio (dBZ_hh - dBZ_hv)" not "Linear depolarization ratio (var_data - dBZ_hv)"

2. Include valid global attributes for history, command_line, process_version.

3. Time dimension should be the first dimension for all two dimensional variables.

4. Input_datastream description should be input_datastreams_description = A string consisting of the datastream(s), datastream version(s), and datastream date (range).

5. missing_values should be missing_value

Having made these and other changes required to conform to the new more rigorous ARM standards, subsequent WACR-ARSCL runs will meet the standards.

I thank the members of the standards review committee for helping move this process forward. Chitra, Ken, Robin, Justin, Krista, and Nicole provided the help and fresh eyes necessary to identify the required changes.

#5: Ways to Expedite WACR-ARSCL to the Archive

Radar Product Development Work Flow
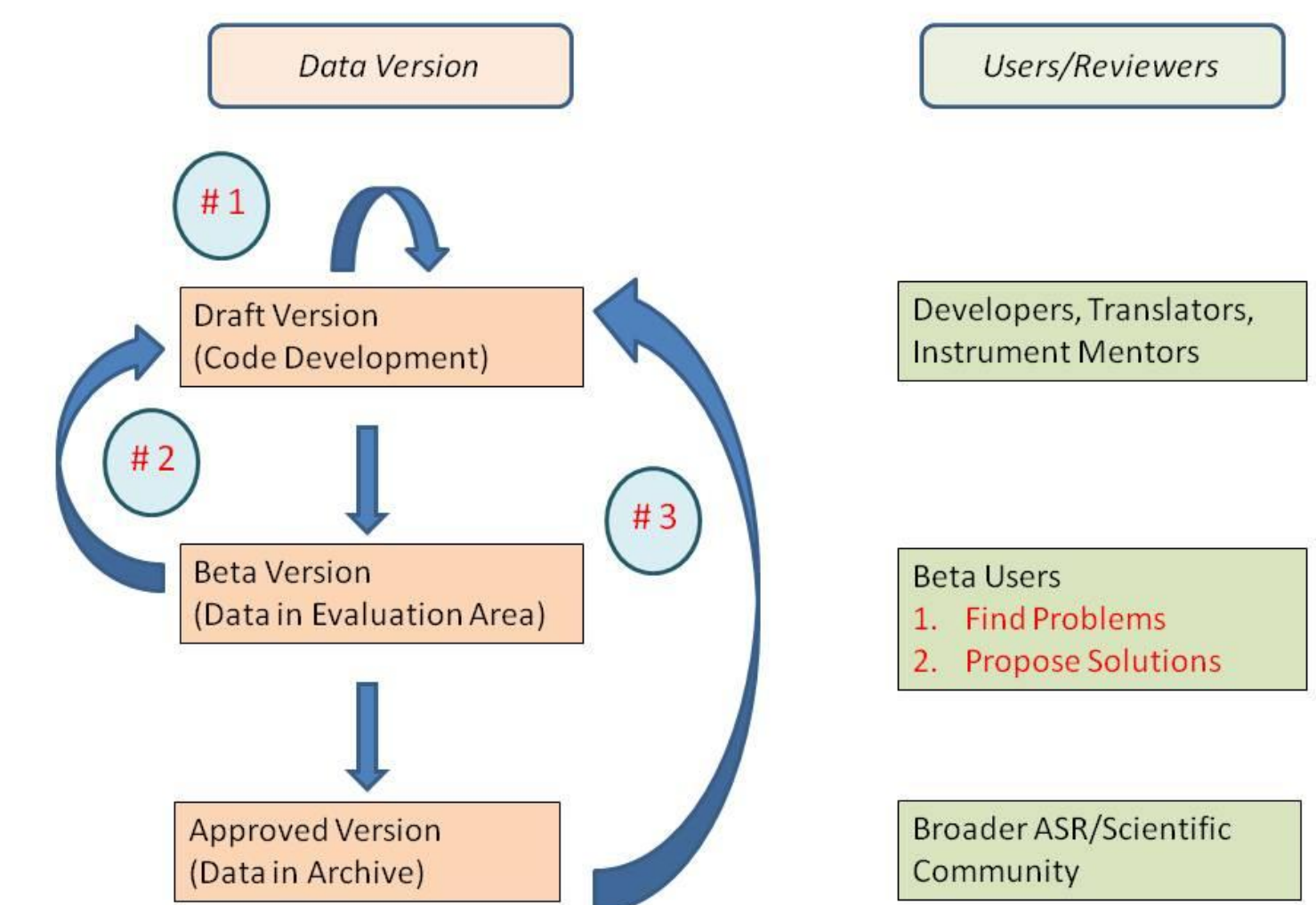
The schematic diagram presented above shows a slightly different view of the work flow associated with VAP development.

The left side shows the data version and the file location. Arrows labeled #1, #2, and #3 are used to show iterations across the different versions. The iterations depend on the input from people found on the right side of the diagram.

We can minimize the time it takes for a VAP to move from Development to Archive by reducing the number of iterations (especially type #2). This is done by having prompt feedback from the Beta User – i.e., users listed on the implementation plan, and others who download evaluation products.

Another method to expedite the move from development to Archive release is for the developer to work though the six month evaluation period as much as possible. This may involve being proactive in soliciting feedback from users or other experts.