Pacific Northwest
NATIONAL LABORATORY

Radar Status : CACTI/RELAMPAGO

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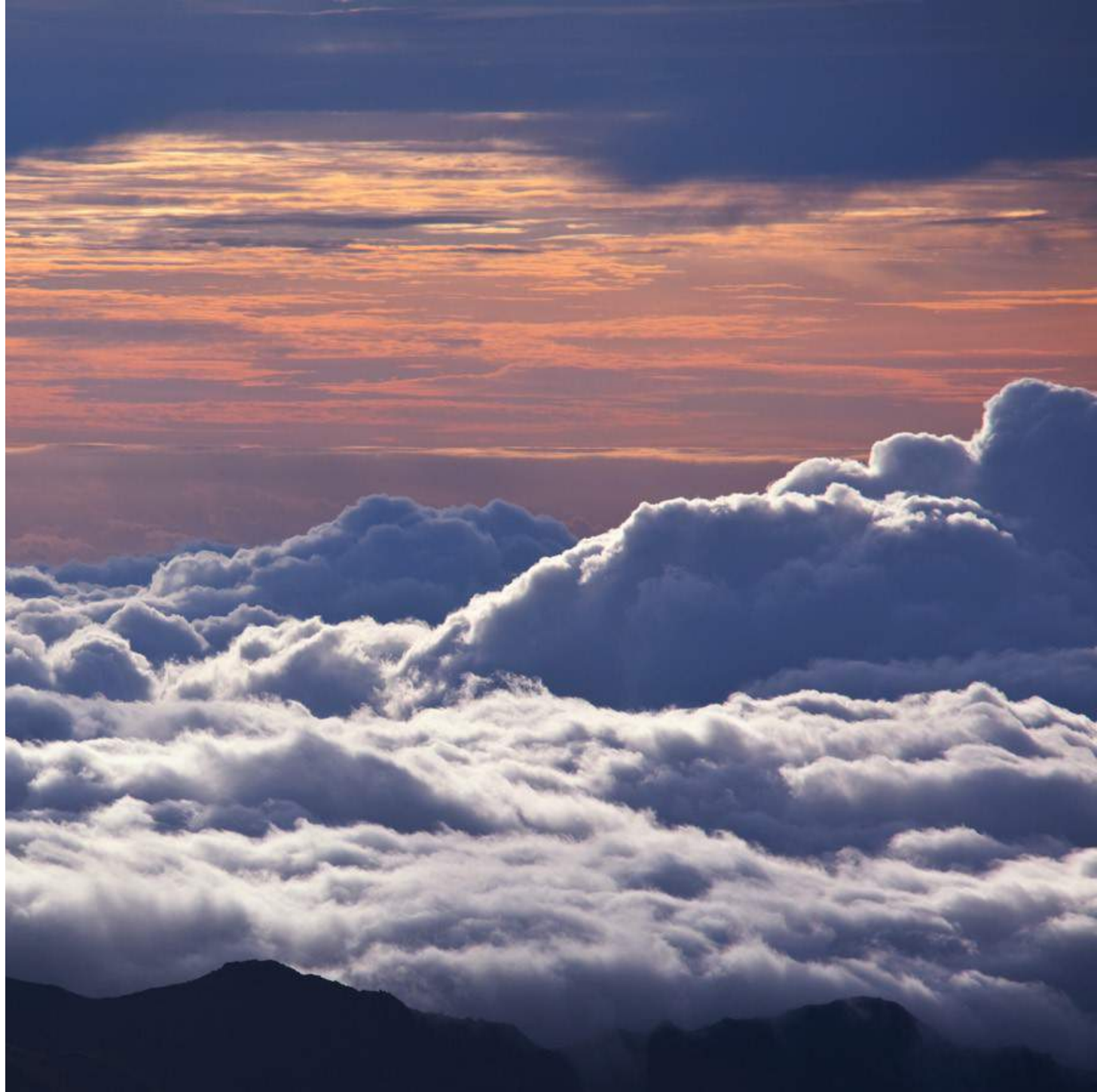


Overview

- ARM deployed 4 radars (CSAPR2, KAZR, Ka/X SACR) to the CACTI field campaign in Argentina.
- Joint campaign with other agencies (RELAMPAGO on NSF side)
- Several firsts
  - First deployment of CSAPR2
  - First ”agile” scanning.
- This talk will cover
  - Environment
  - Status of Operations
  - Future Plans (Data)

Technician slide

- First I'd like to thank the technicians that kept the site running. (Not pictured: Bruno Cunha and Brandon Androes (Installation)

Vagner Castro

Tercio Silva

Juarez Viegas

Peter Argay

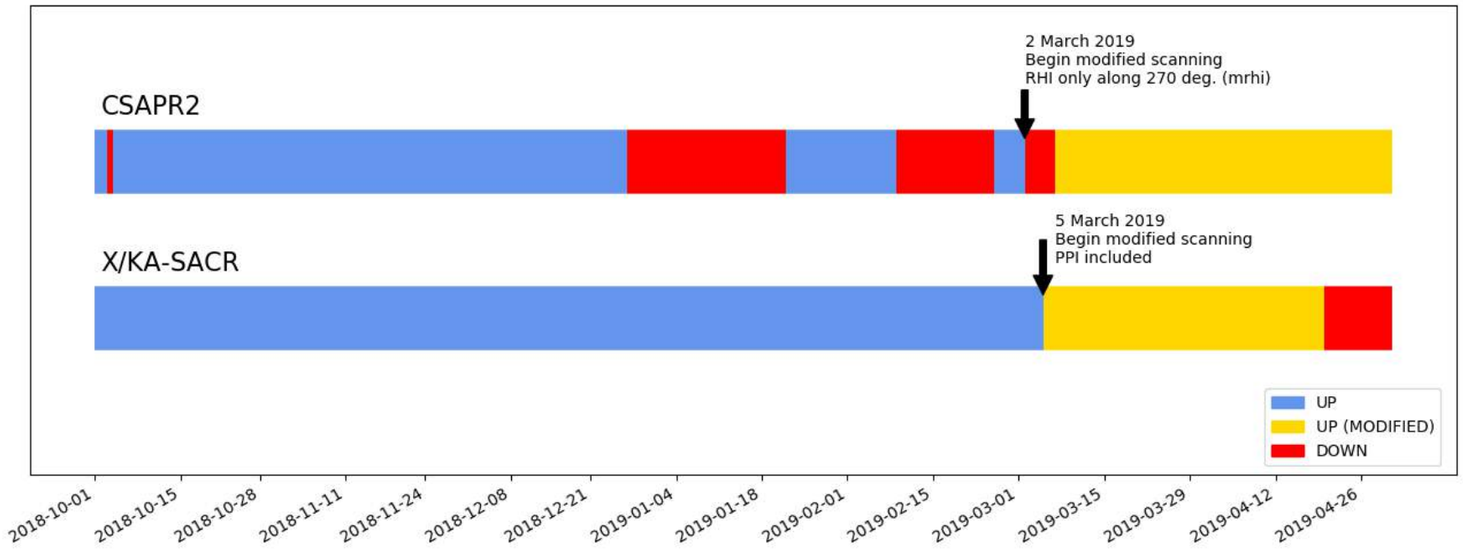
Todd Houchens

Video Courtesy Tim Goering

Radar Operations

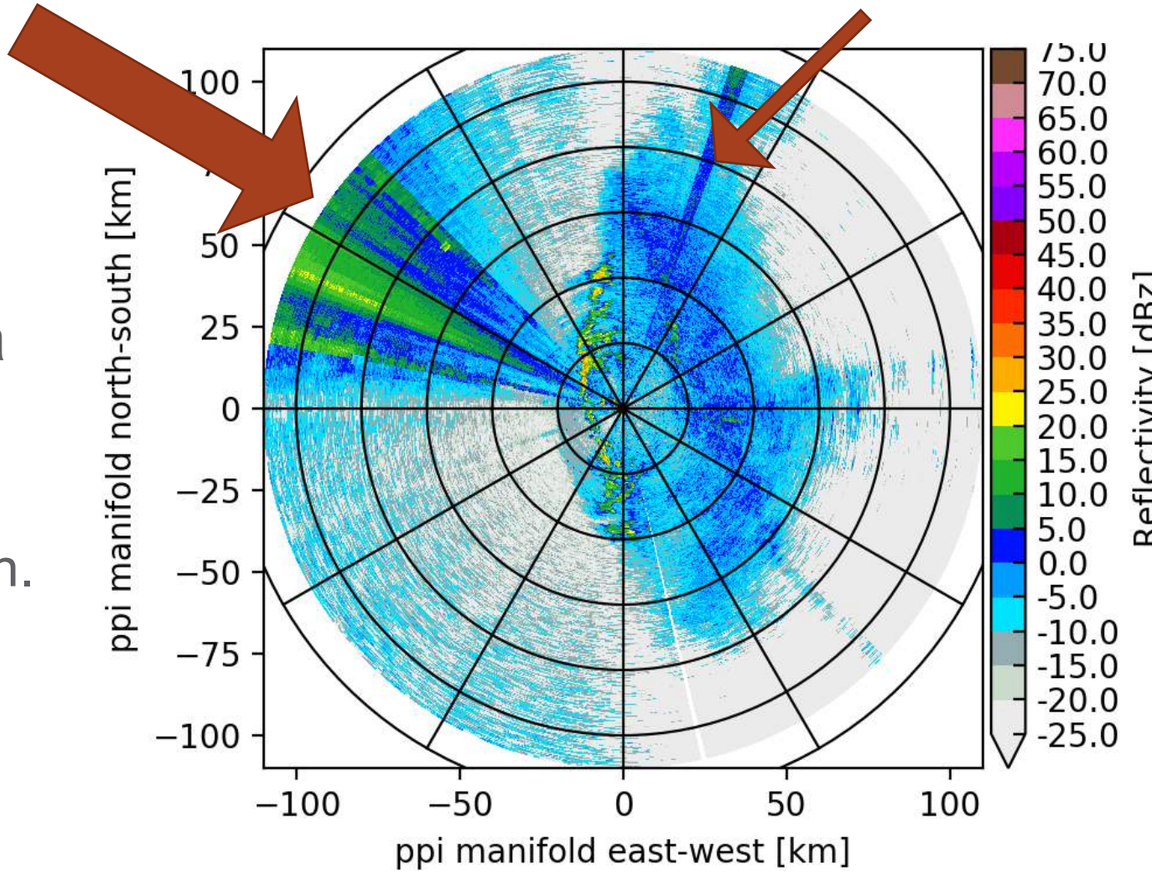
- Overall the radars gave good performance during the campaign.
- Some outages due to component failures.
- Pedestal failure March 2nd required a change in scan strategies.
- Waveguide blockage issues with KaSACR
- Generally all instruments survived the entire campaign!

CACTI scanning radar uptime (At least 1 file that day)



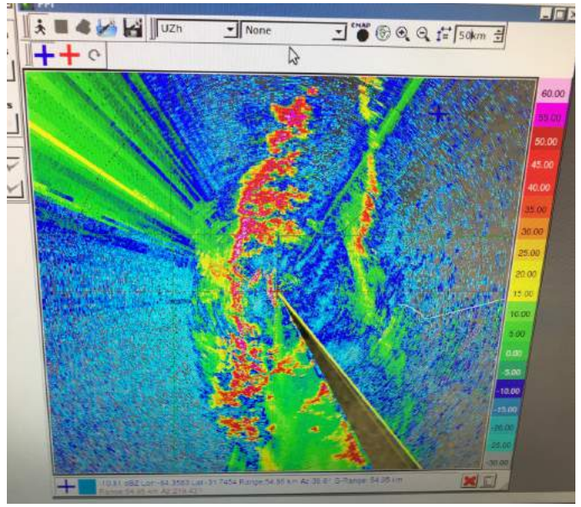
General Environment

- Installed outside Villa Yacanto, Argentina
- Notable features:
  - RF Interference from nearby comms tower and Cordoba, and another unidentified town.
- Significant ground clutter
- Significant blockage to the west, and partial blockage to the east.



Communications Tower (3 km away)

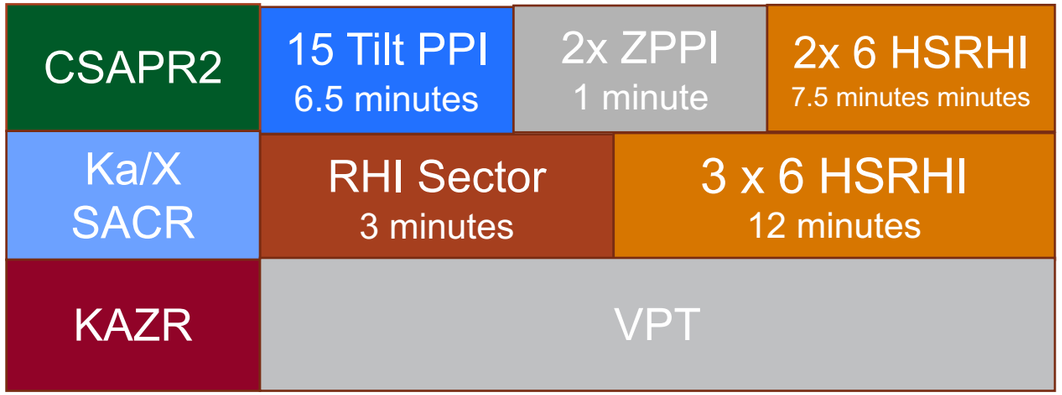
First scan with radar.
CLEAR DAY…
Not Ideal.



Scan Strategy

- Scan Strategy during most of campaign on 15 minute heartbeat designed to synchronize radars.

CACTI Scan Strategy

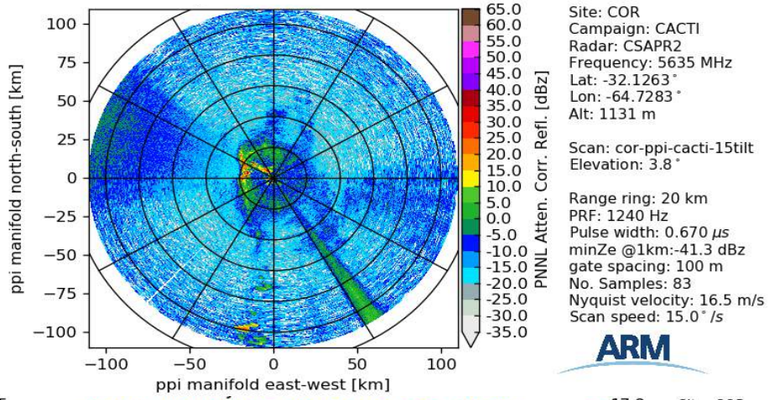


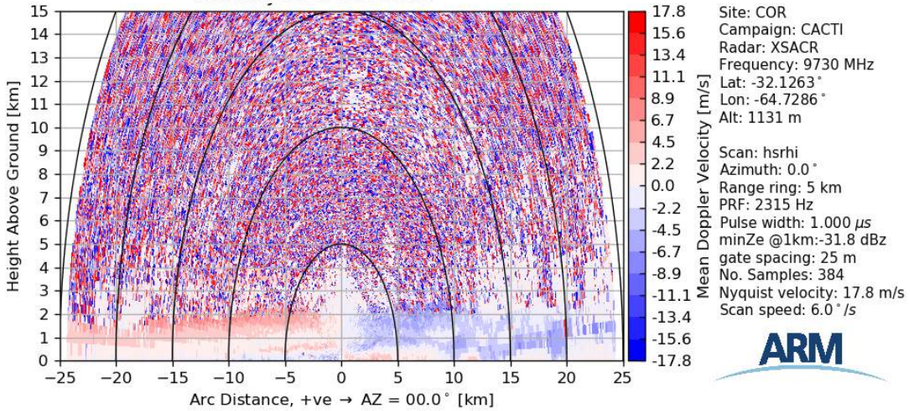
- Goals to capture initiation and upscale growth.
- CSAPR2 provides context, SACR provides vertical structure.
- Overlap in HSRHI provides for cross comparison and multi frequency approaches.

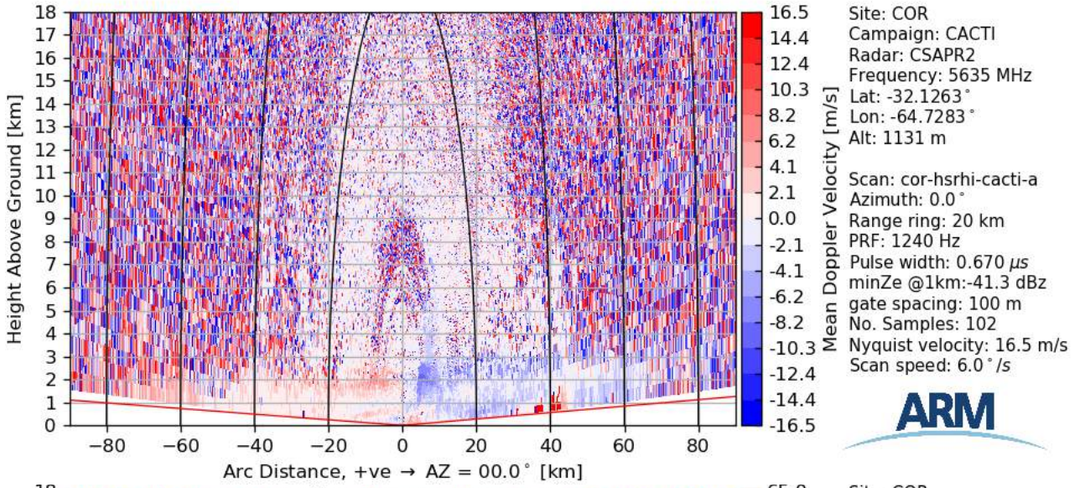
- Later modified when motor failure limited CSAPR2 field of view.
- Also modified during “Agile scan periods”

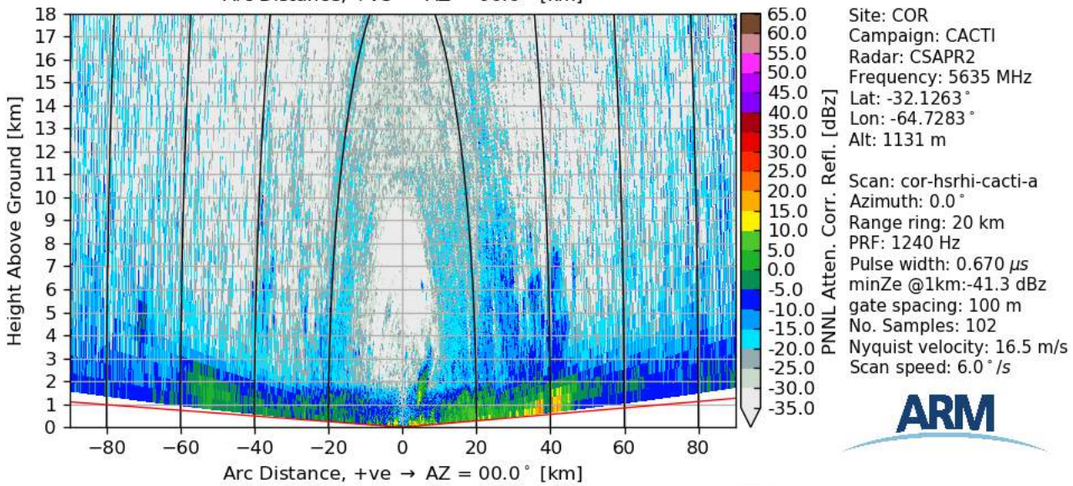
Large Supercell

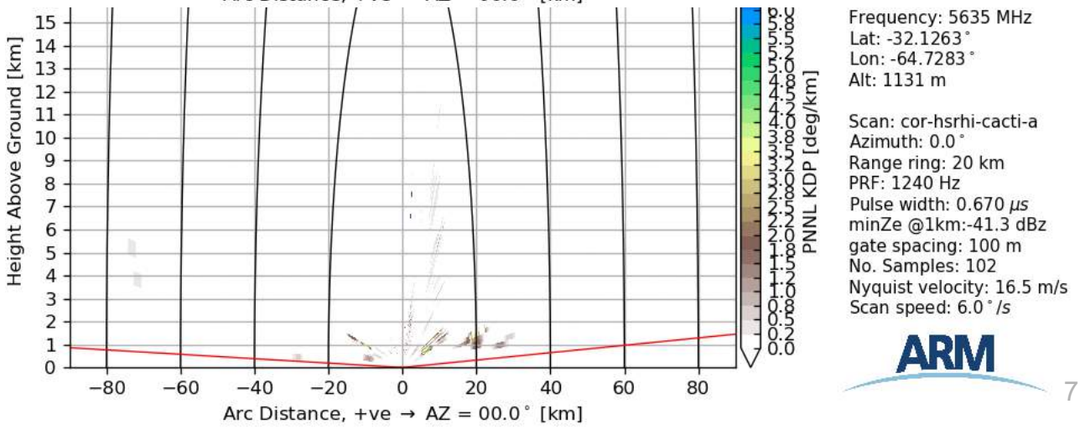
- We captured many great cases.
- Example: Large system moved directly over the site.





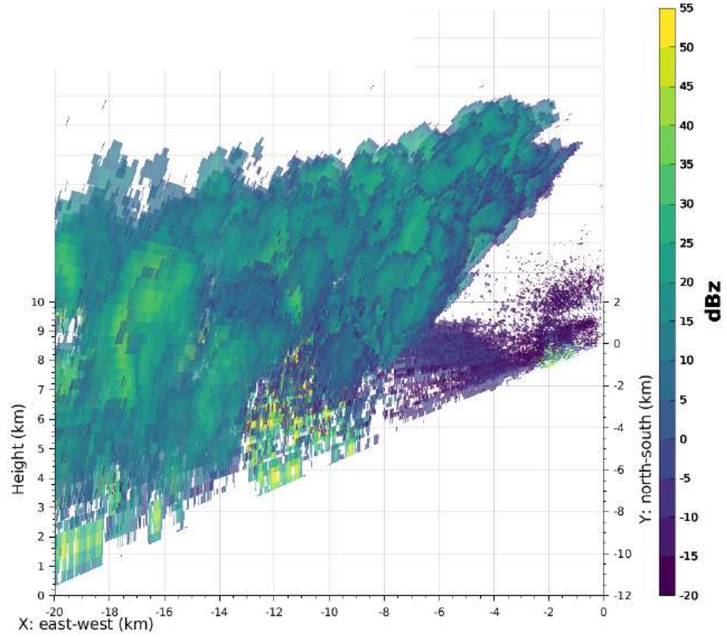


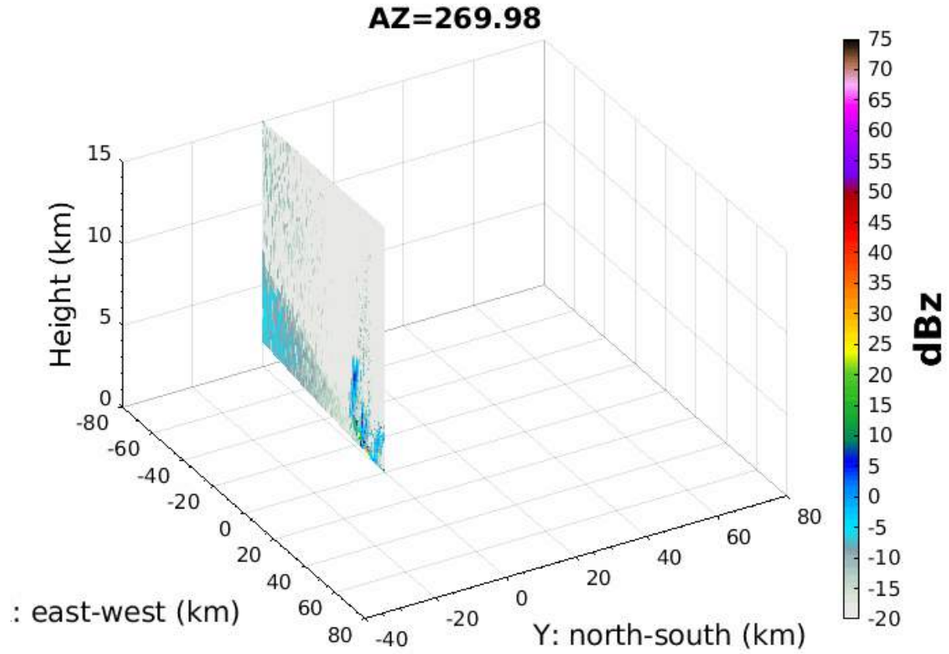




Agile Scanning

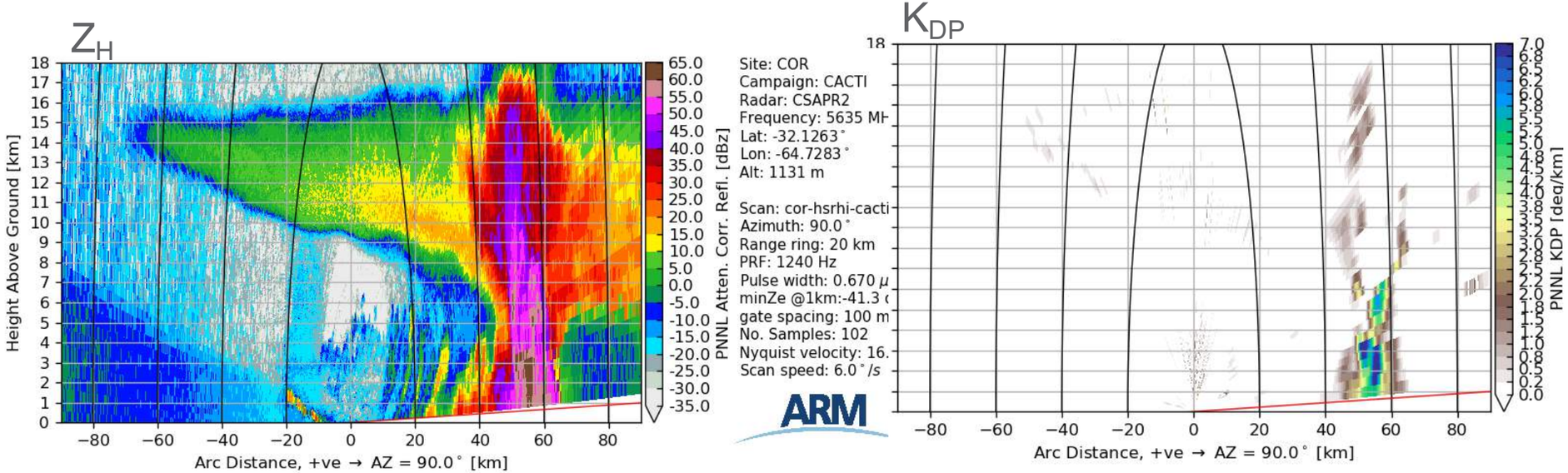
- First campaign where we've done agile scanning
- Coordination with CACTI science team to update CSAPR2 scan strategies in real time to track convection during several cases.
- HSRHI's replaced with RHI sectors and updated every 15 minutes.
- RHI sampling as fine as 1deg intervals (range 1-6 degrees depending on scan width).
- Developed a secondary scan controller to enable fast switching.





Taranis

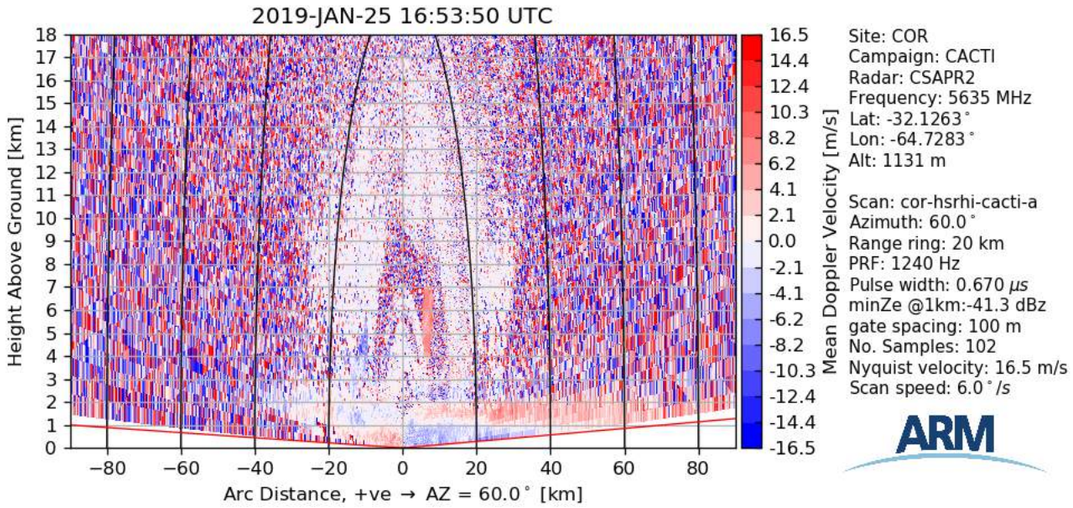
- Taranis is a set of radar products developed under the PNNL CMDV project.
  - Includes Kdp, attenuation correction, hydrometeor identification, DSD estimation, QPE, and quality masks.
- Continued funding to process CACTI dataset.
- Taranis was running in real-time during CACTI.
- More information about Taranis in Plenary session presentation.



Bharadwaj, Hardin, Giangrande *"A self consistent KDP and attenuation estimator for multiple frequencies" [In preparation]*

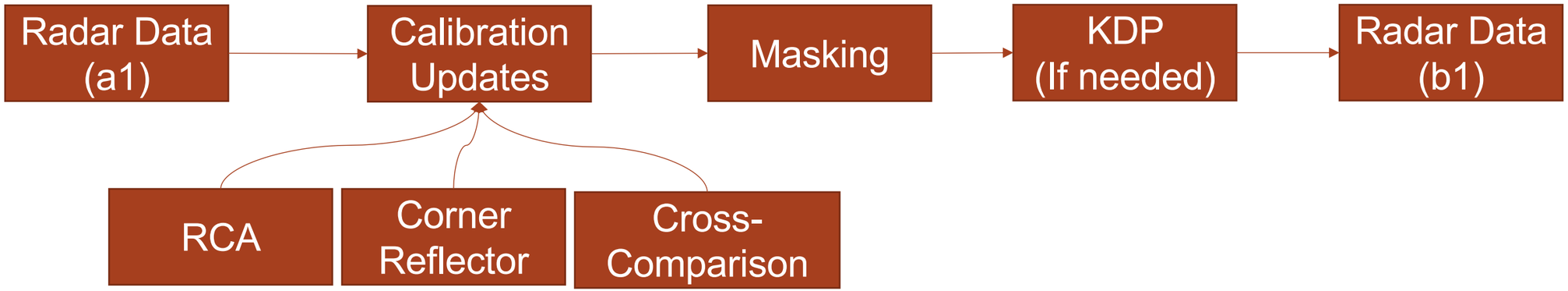
Real-time Imagery

- Radar team implemented quicklooks for all radars during the campaign.
  - Quicklooks incorporated attenuation correction, masking, and other products from Taranis
  - These quicklooks were available in real time.
- Radar quicklooks currently available online
- In addition to radar, there are camera quicklooks available from a surveillance camera at 2 minute intervals.
- Working on setting up an archival page for access with all sweeps/vars plotted.



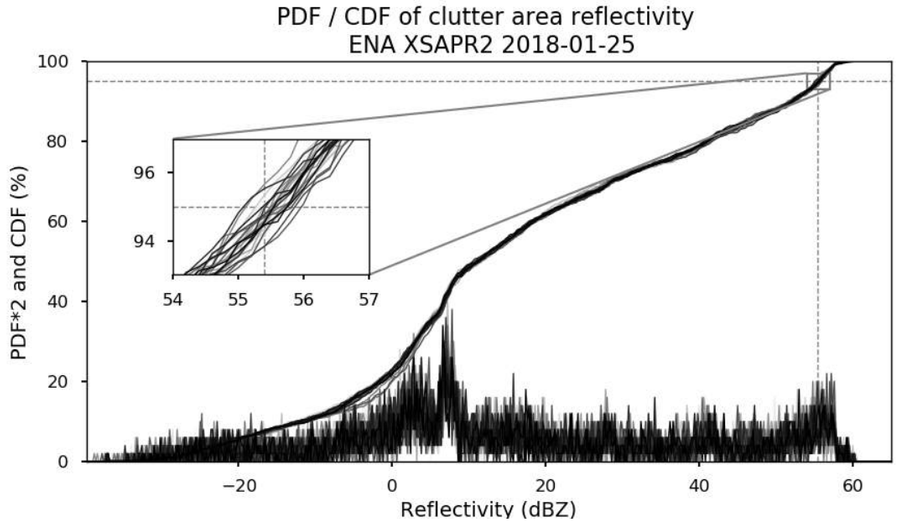
Data Processing Plans (b1)

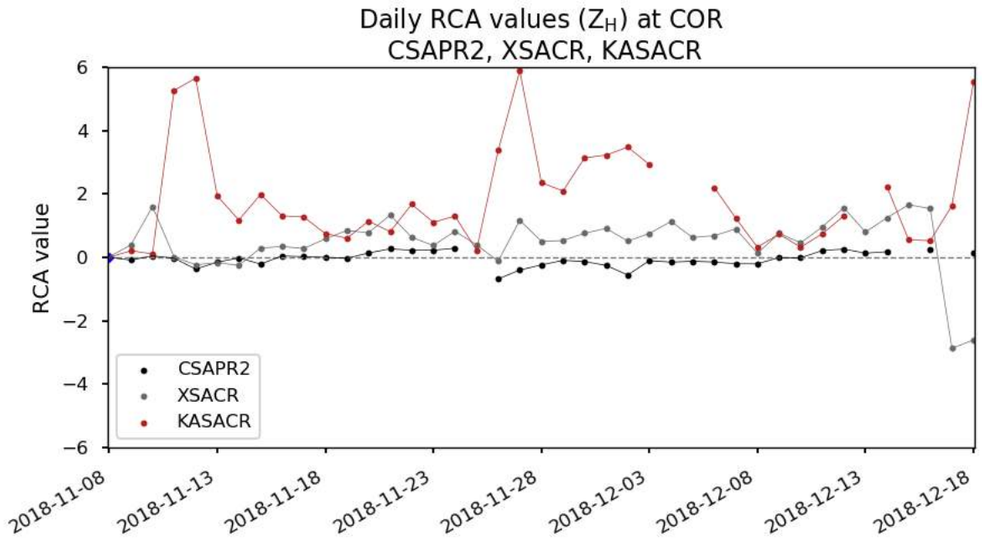
- Currently all “a1” data is available. This data is the raw data from the radars with no additional processing.
- Working on “b1” data which will include quality control masks, and calibration updates.
  - Release plan is end of CY 2019 for several epochs.
- All radars will be brought to a common calibration point.
- Much of the calibration equipment never arrived on site so we’re using a combination of on radar measurements, and other techniques to ensure a consistent calibration record.



RCA Examples

- Relative Calibration Adjustment is a technique for monitoring calibration stability from PPI data using statistics of ground clutter.
- We've adapted it to work with RHI's and higher frequency radars.
- Run in real time on all CACTI scanning radars.
- Provides daily calibration log that was available daily during campaign.
- Given an absolute calibration, allows us to connect the dots to other time periods.

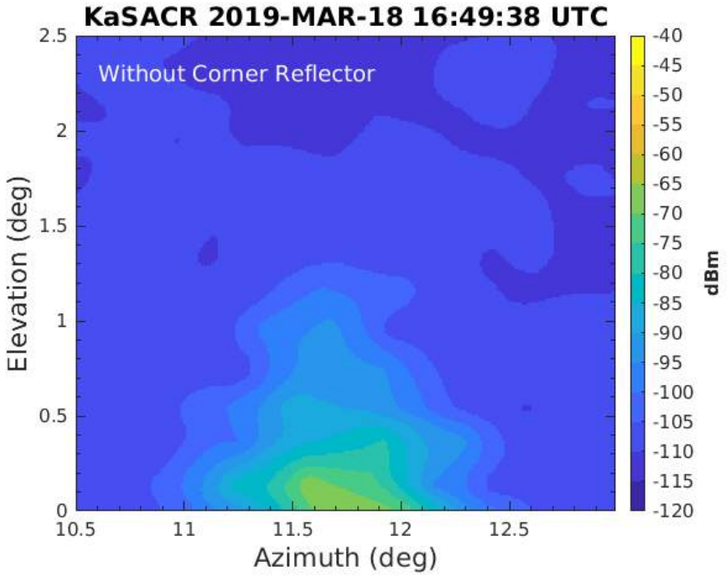




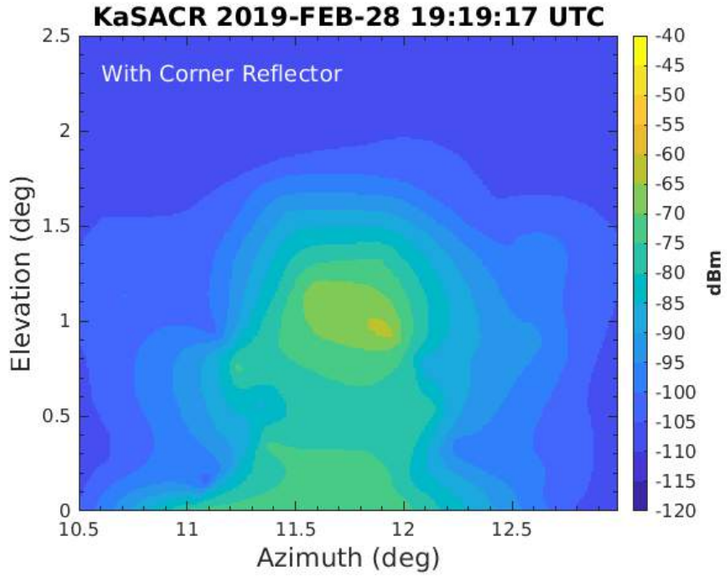
[1] Hunzinger, Hardin, Bharadwaj, "Extending the radar relative calibration adjustment technique to higher frequency radars and research scan strategies.", *In Preparation*

Corner Reflector

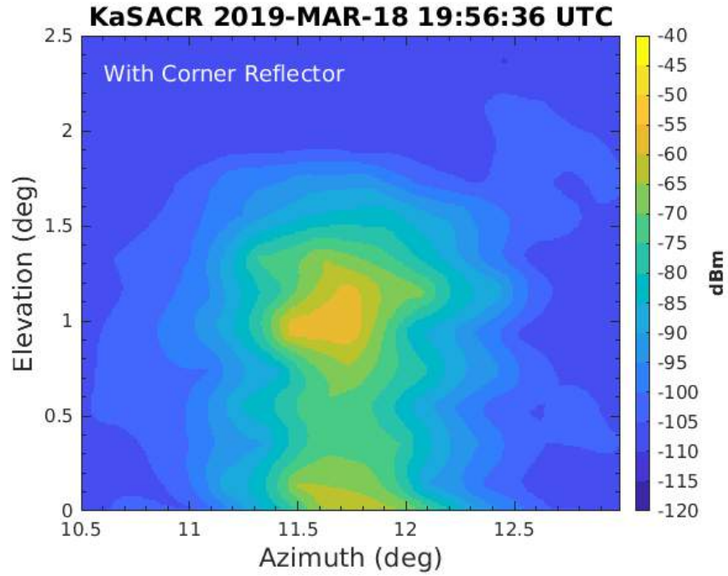
- Corner reflector combined with on-site measurements allows us to calibrate reflectivity in the radar.
- Combination of RCA and corner reflectors caught a waveguide issue in the KaSACR (more later).



With Blockage

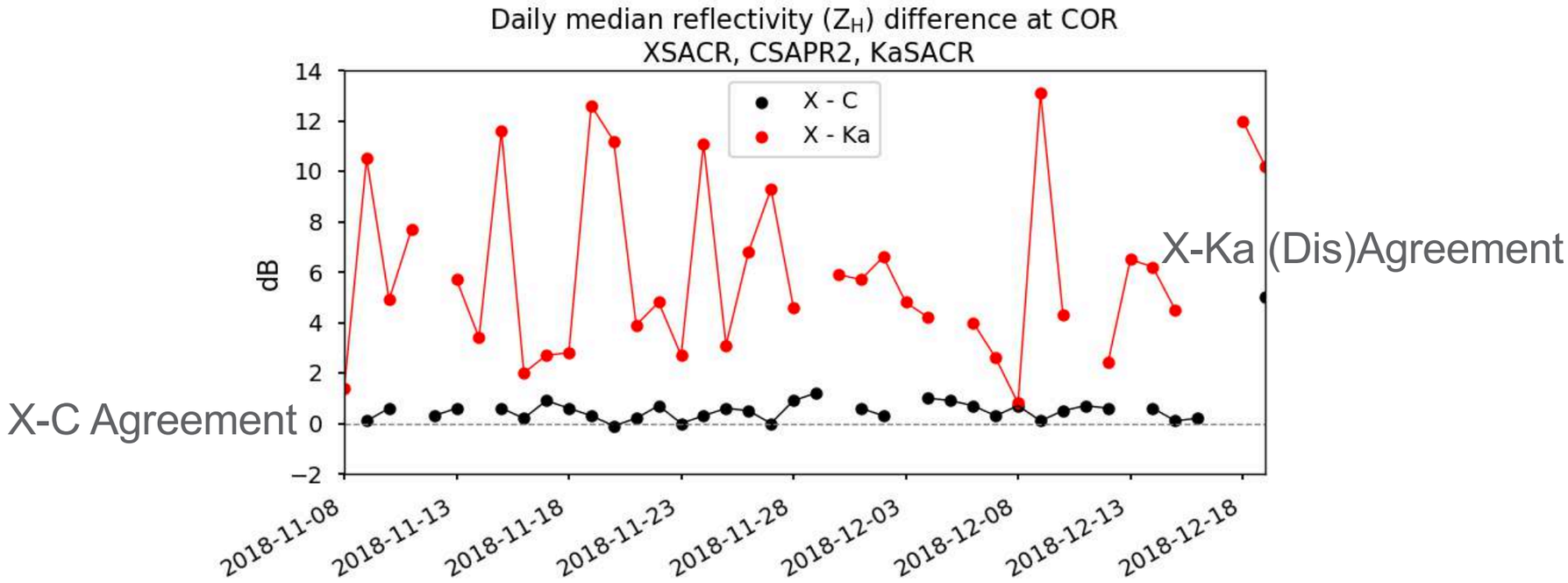


Blockage Removed



Cross-Calibration

- We can cross-compare the results from each radar to estimate a “relative” calibration between instruments.
- After calibrating each instrument individually, we’ll use cross-calibration results to remove any final disagreement.
- Before waveguide clearing, this will help re-calibrate KaSACR.

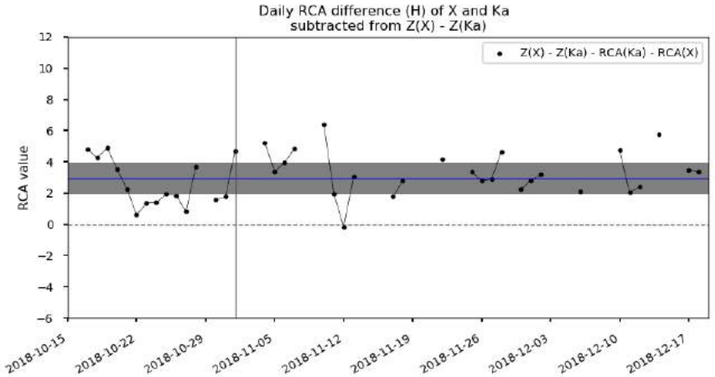


X-C Agreement

X-Ka (Dis)Agreement

Issues

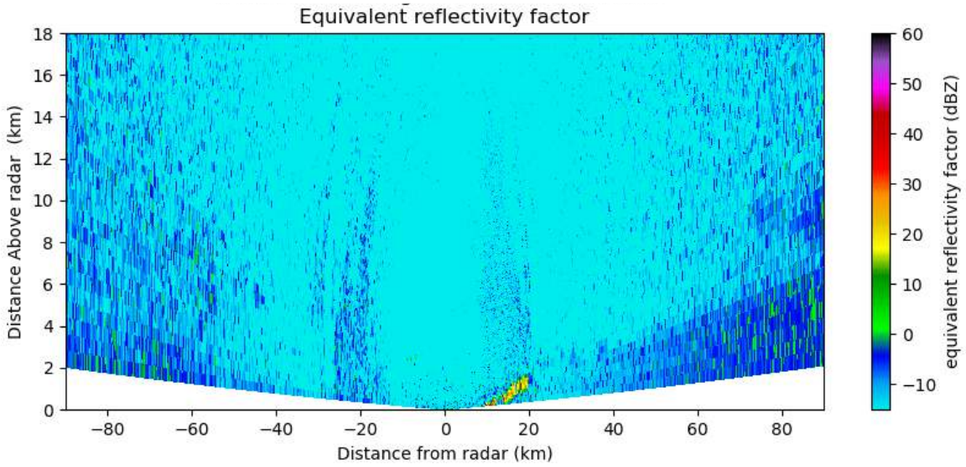
- We encountered several issues during the campaign
  - The site would lose power on many occasions, and failures often followed these outages
  - Interference from nearby sources.
- Blockage in waveguide for KaSACR
  - Debris inside waveguide caused calibration to vary.
  - Should be able to re-calibrate, but will take longer.
- Failure in azimuth motor for CSAPR2
  - Required changing SACR to add PPIs and remove sector RHIs
  - CSAPR2 switched to RHI only along one azimuth.

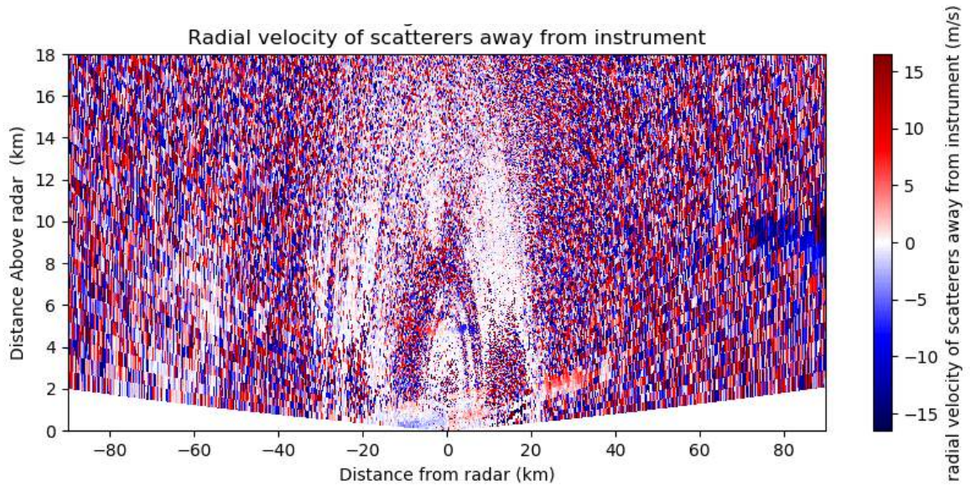


- Last minute location change of radar caused blockage to south of SACR (By the CSAPR)

45 Second Update mode

- A failure in azimuth motor resulted in CSAPR2 being unable to scan in azimuth.
- We implemented a continuous HSRHI scan at 270 azimuth.
- 45 second heartbeat.
- We also see a periodic interference signal. Not quite sure what this is yet.





Packup

- The site was successfully packed up and the radars shipped off to next deployments
- KAZR will go to COMBLE
- SACR will go to PNNL
- CSAPR2 will go to SGP to undergo adaptive scanning development for TRACER.

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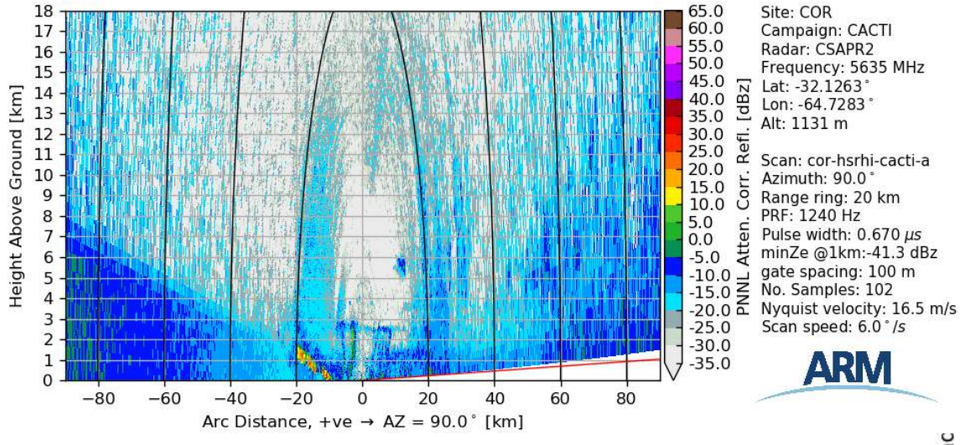

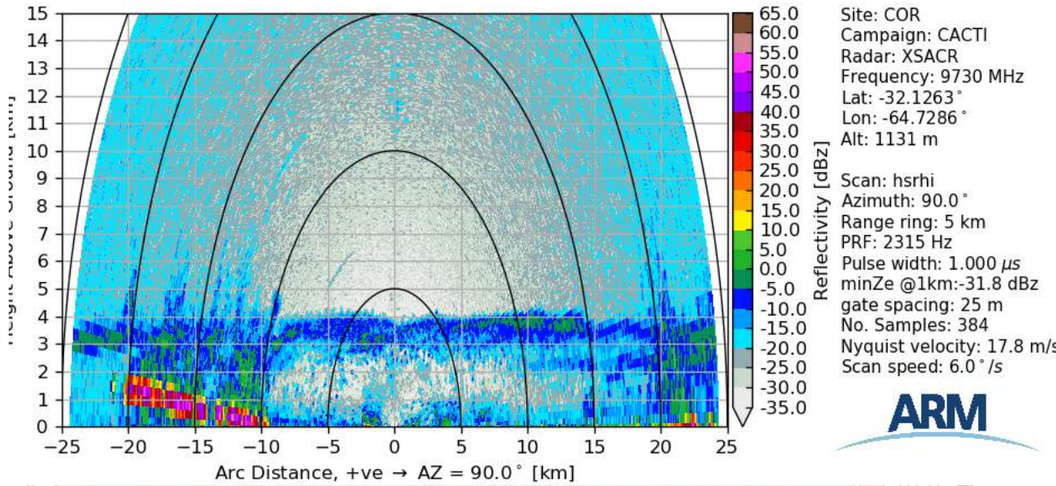

Questions? Email

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