

# A First Look at Cloud Radar Value-Added Products during the CACTI ARM Mobile Facility Deployment



Karen L Johnson<sup>1</sup>, Scott E. Giangrande<sup>1</sup>, Pavlos Kollias<sup>1,2</sup>,  
Meng Wang<sup>1</sup>, Tami Toto<sup>1</sup>, Aifang Zhou<sup>1</sup>, Lynn Ma<sup>1</sup>

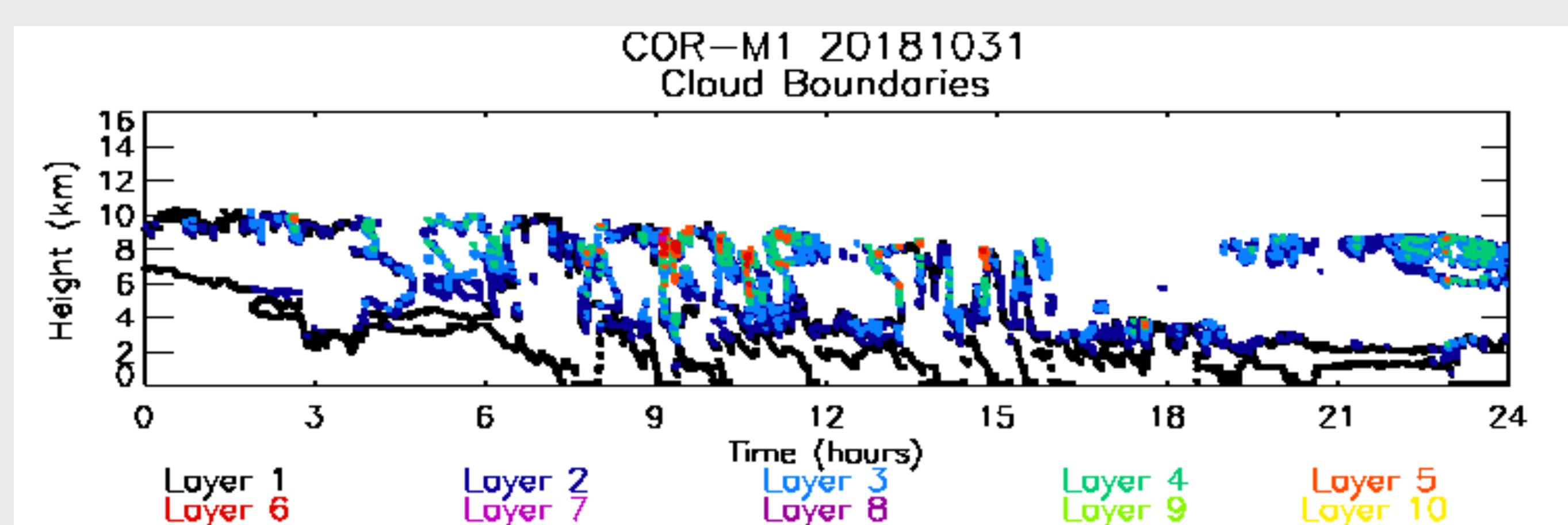
<sup>1</sup>Brookhaven National Laboratory <sup>2</sup>Stony Brook University  
Corresponding author: Karen Johnson, kjohnson@bnl.gov



## CACTI: Cloud, Aerosol, and Complex Terrain Interactions ARM Mobile Facility (AMF) Deployment

The CACTI AMF deployment to the Sierras de Córdoba mountain range of Argentina has recently concluded. Cloud radar Value-Added Products (VAPs) are in development. Evaluation products will be available for the entire campaign this summer.

The Active Remote Sensing of Clouds (ARSCL) VAP provides cloud (hydrometeor) boundaries and corrected best-estimate radar moments in profiles over the main AMF site by merging cloud radar, lidar and sounding observations.

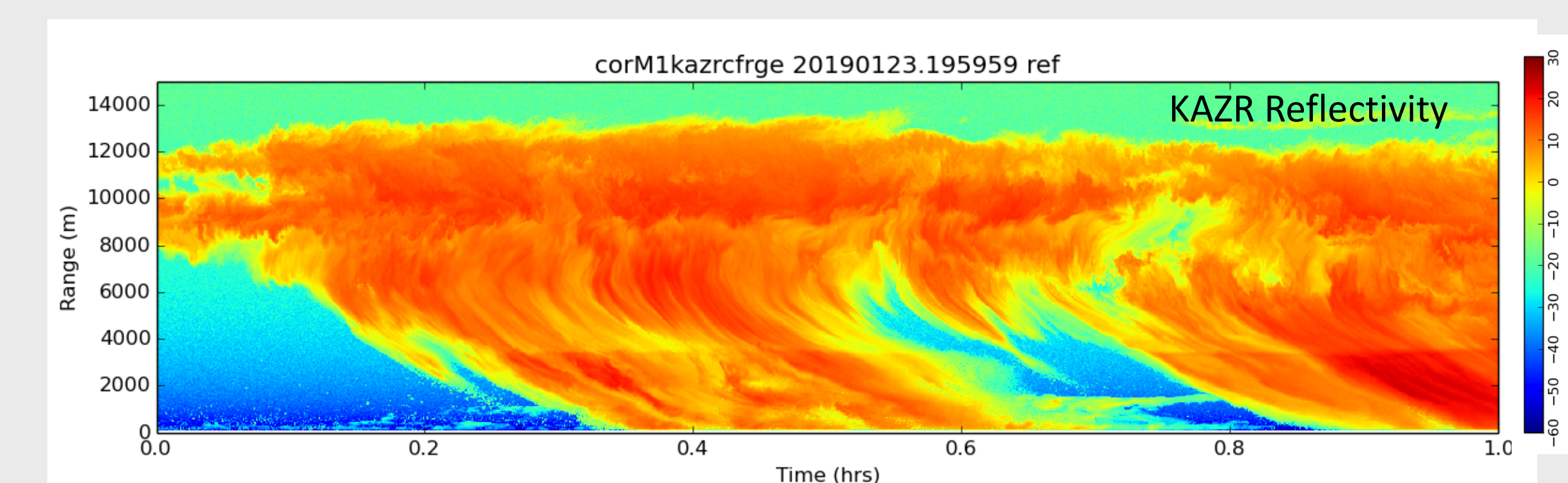


The Scanning ARM Cloud Radar (SACR) VAPs include the SACR Corrections VAP (SACRCOR) and the SACR Advanced 3-Dimensional Cartesian Cloud Cover VAP (SACRADV3D3C). The SACR products correct for gaseous attenuation and convert radial radar data into Cartesian gridded form.



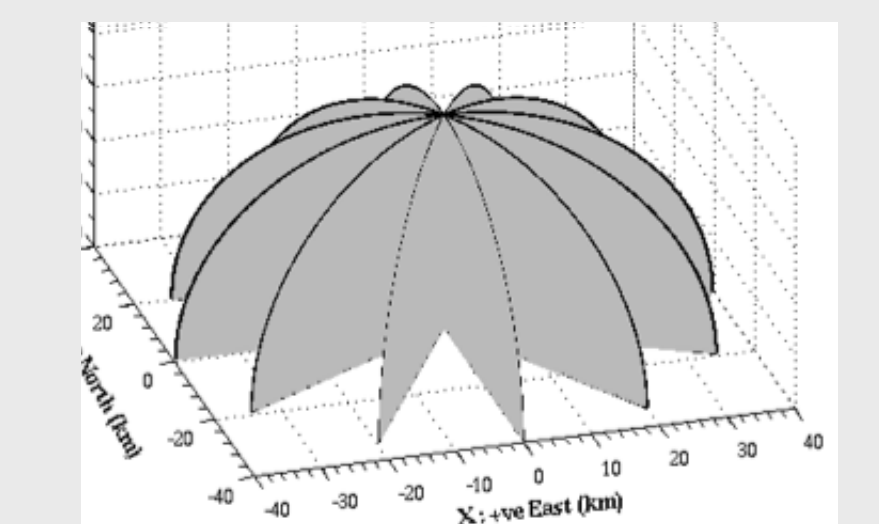
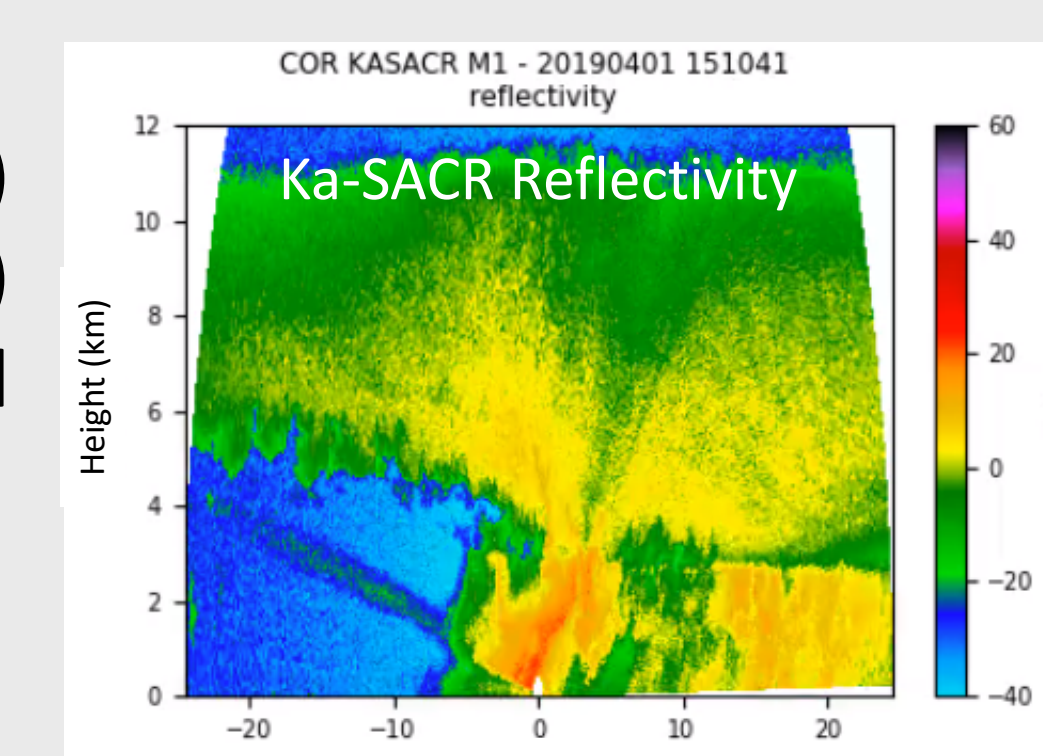
## CACTI Cloud Radars

The Ka-band ARM Zenith Radar (KAZR) is a 35-GHz zenith-pointing radar which records profiles of reflectivity, mean Doppler velocity, and spectral width every 4 seconds with a vertical resolution of 30 m.



Two Scanning ARM Cloud Radars (SACRs) were also deployed, at Ka-band (35 GHz) and X-band (9.7 GHz). The SACRs scanned in a repeated sequence of several modes:

- Hemispheric Range-Height Indicator (HSRHI): 12 scans/hour
- Range-Height Indicator (RHI) sector scans: 4 scans/hour
- Plan Position Indicator (PPIV): 4 scans/hour (after 3/2019)

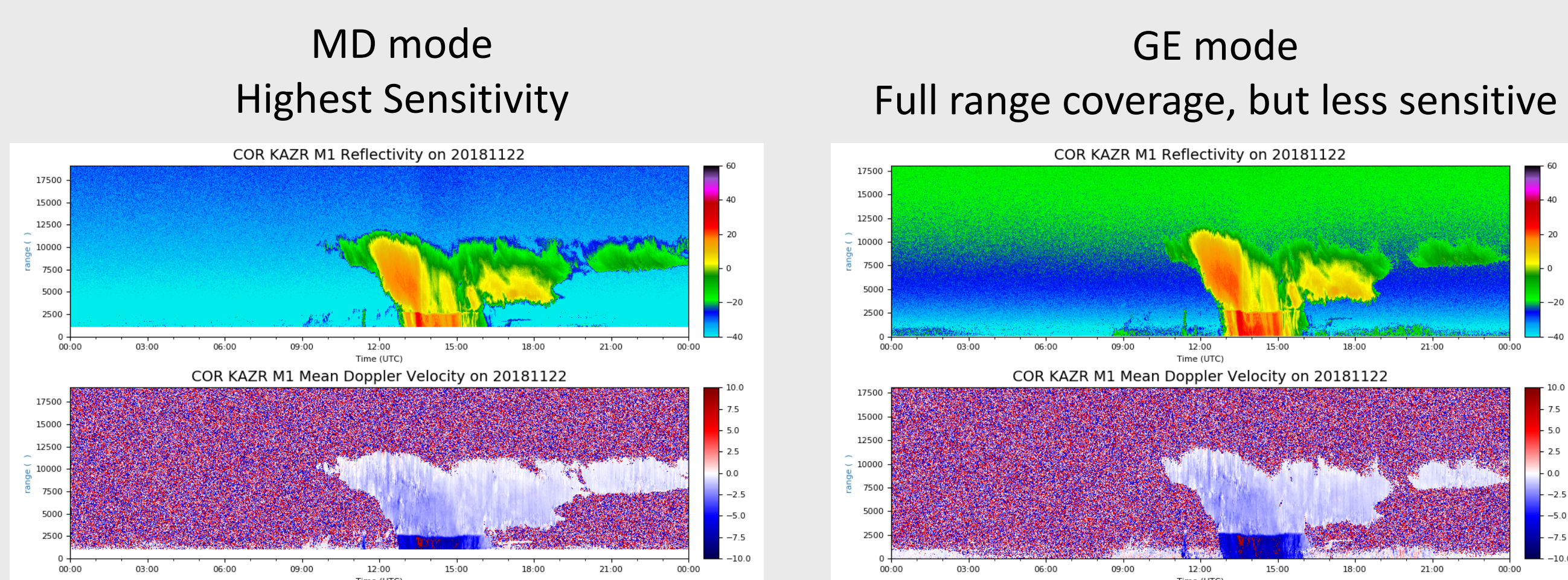


## KAZR-based Value-Added Products

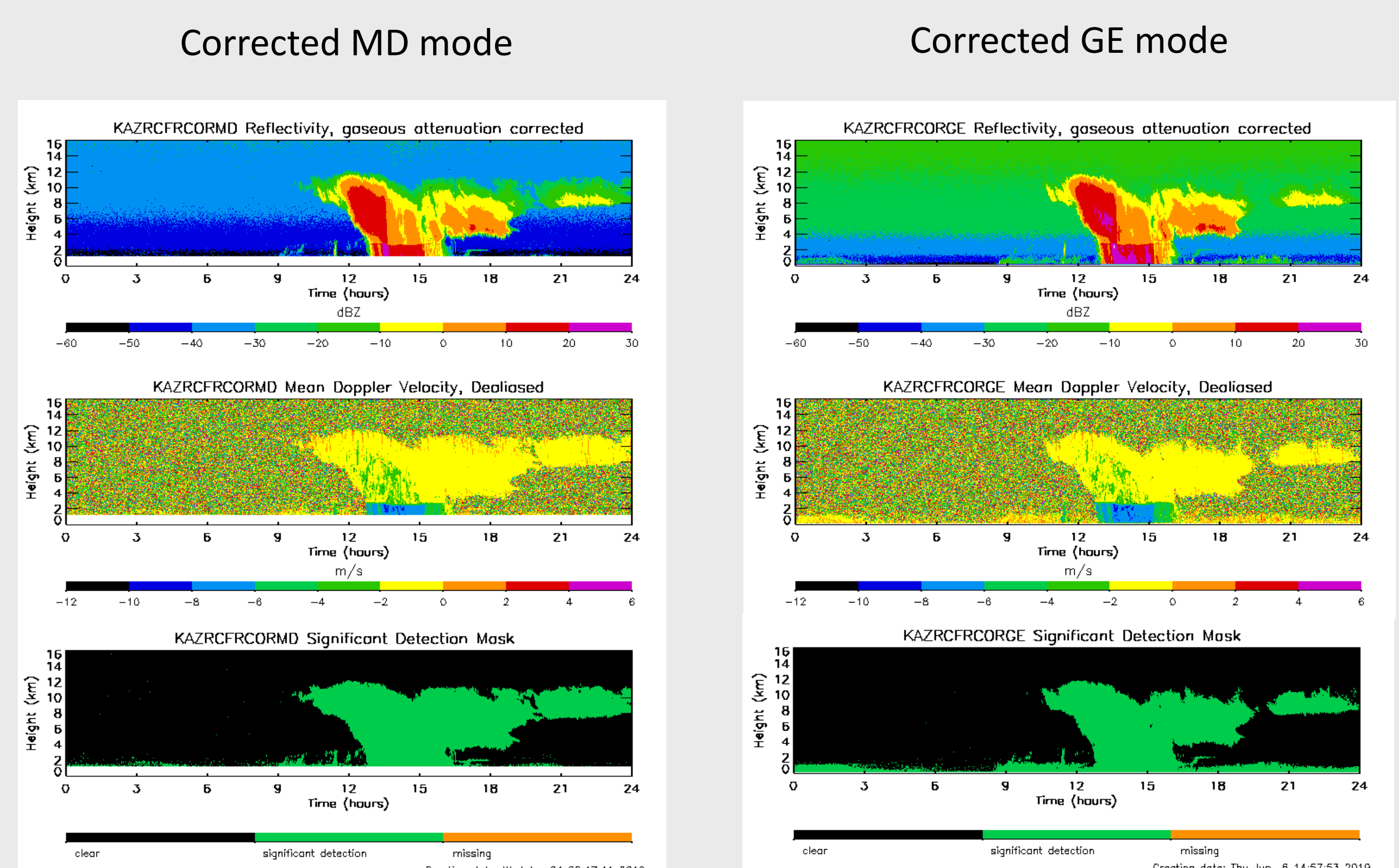
The primary profiling cloud radar product is **KAZR-ARSCL**, which provides cloud boundaries and best-estimate KAZR moments. KAZR-ARSCL builds on the KAZR Corrections VAP, KAZRCOR, which is a precursor product.

**KAZRCOR** combines KAZR and atmospheric sounding measurements to correct reflectivity for gaseous attenuation, dealias (unfold) mean Doppler velocities and create significant detection masks. KAZR-ARSCL uses the KAZRCOR product, along with Micropulse Lidar, Ceilometer, and Microwave Radiometer measurements to optimally merge KAZR operating modes, determine cloud boundaries and flag and remove clutter. The VAPs will be processed first with 'a1-level' KAZR input and then with 'b1-level', when available.

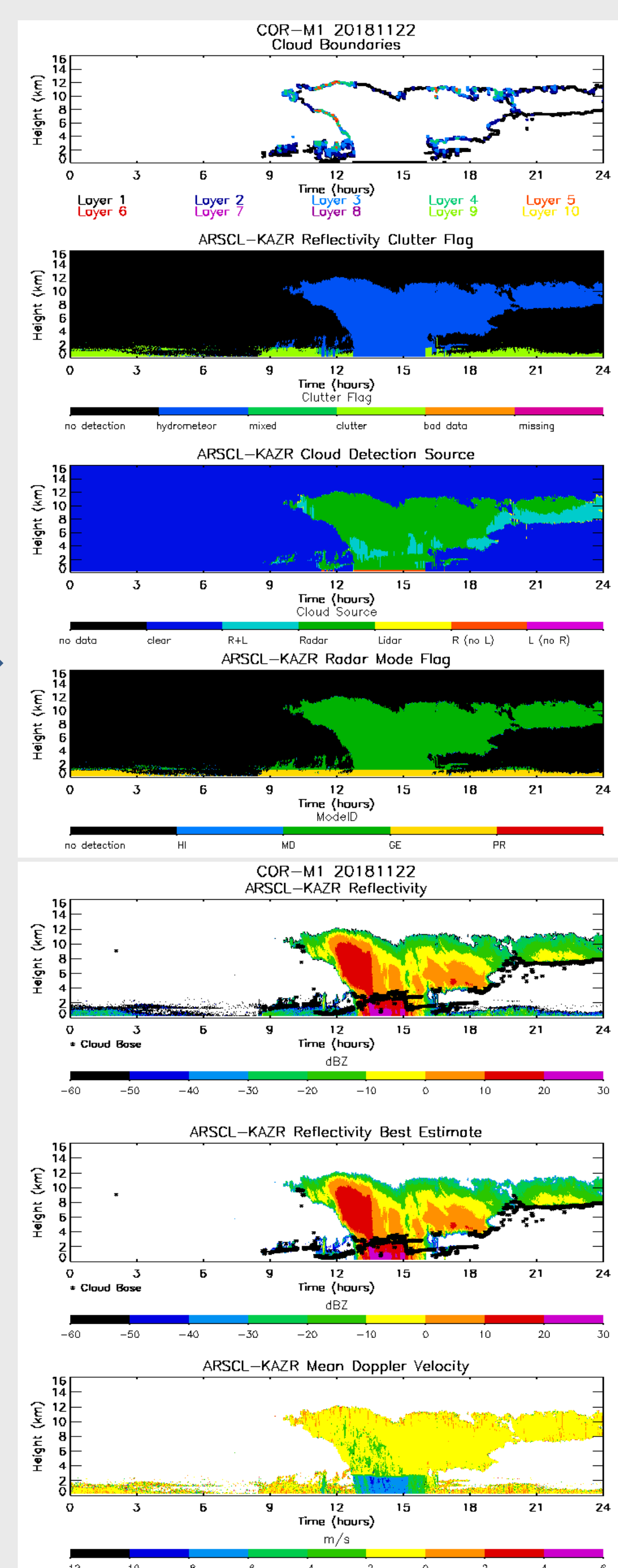
### KAZR Observations



### KAZRCOR VAP



### KAZR-ARSCL VAP



## Cloud Radar Data Formats and Processing Chain

The KAZR and SACR datasets at CACTI have adopted the widely used CF/Radial data standard (as all ARM radars will soon). KAZR-ARSCL products have been updated for this format change and to merge the KAZR and KAZR2 VAP versions. The SACRADV family of VAPs is also being updated to accept the new CF/Radial format.

Radar data is ingested to create ARM 'a1-level' CF/Radial datastreams. The next step in the processing chain is to calibrate reflectivities, apply significant detection and beam blockage masks, unfold velocities and perform polarization processing where appropriate. This results in 'b1-level' radar datastreams.

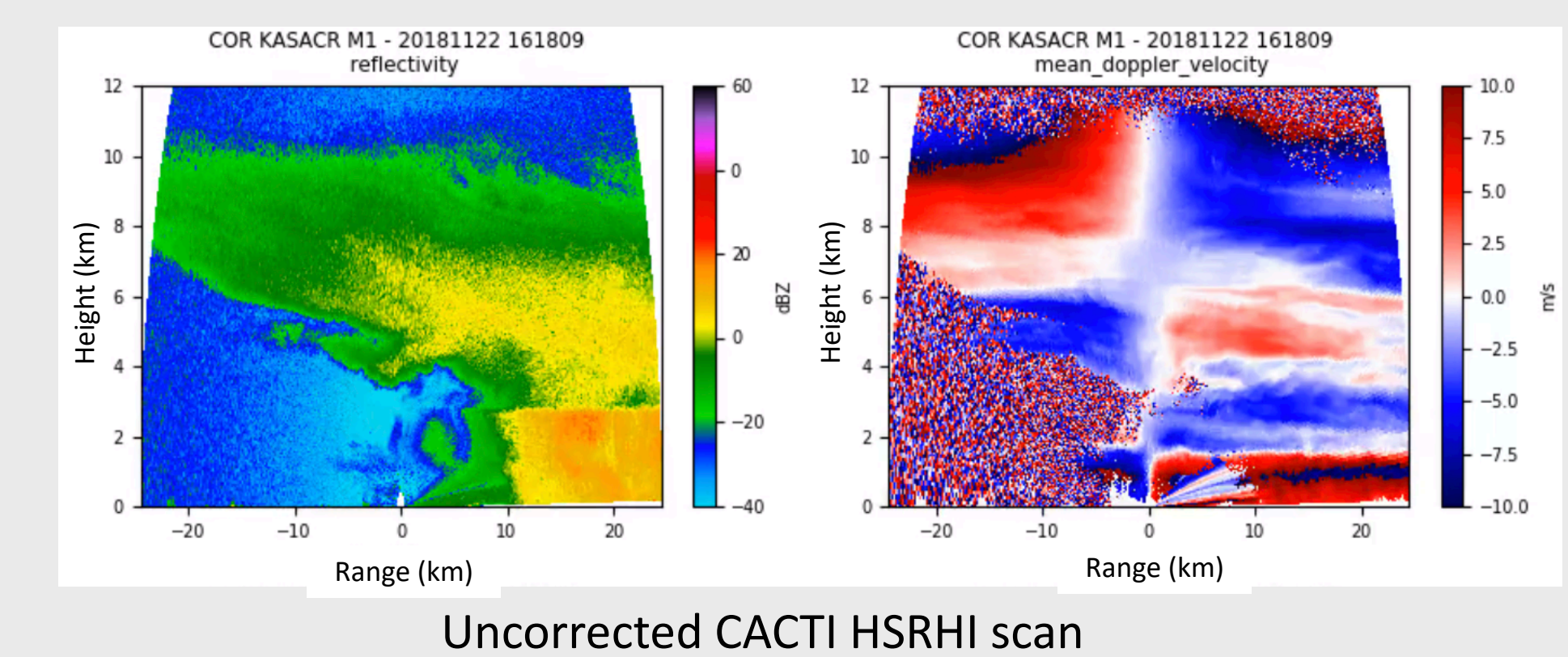
Radar VAP output datastream filename extensions vary, based on radar input data level, e.g.:

kazr\*.a1 radar data → Radar VAPs → arscikazr1kollias.c0 VAP datastream  
kazr\*.b1 radar data → Radar VAPs → arscikazr1kollias.c1 VAP datastream

## SACR-based Value-Added Products

The SACRCOR and SACRADV3D3C VAPs are currently under development for CACTI. The revised **SACRCOR** VAP corrects reflectivities for gaseous attenuation. The SACRCOR product is then used as input to all SACR Advanced VAPs applied at a given site.

An initial evaluation version of the **SACRADV3D3C** VAP exists for the cross-wind RHI scan strategy at the SGP site. The VAP is now being updated to grid the HSRHI scan type measurements from CACTI, as well as other scan types. Each set of HSRHI sweeps comprising a data file will be gridded in time and height. Note that SACRADV3D3C will only be produced using calibrated .b1-level SACR data.



## SUMMARY

CACTI evaluation products based on the profiling KAZR radar will be available at the ARM Archive in late July 2019. This product includes cloud boundaries and best-estimate radar moments.

The SACRADV3D3C Cartesian gridding VAP will provide corrected radar moments on a Cartesian grid. This product is expected to be available at the ARM Archive by early 2020.