# SCANNING CLOUD RADAR PRODUCTS – BEYOND SACRCORR

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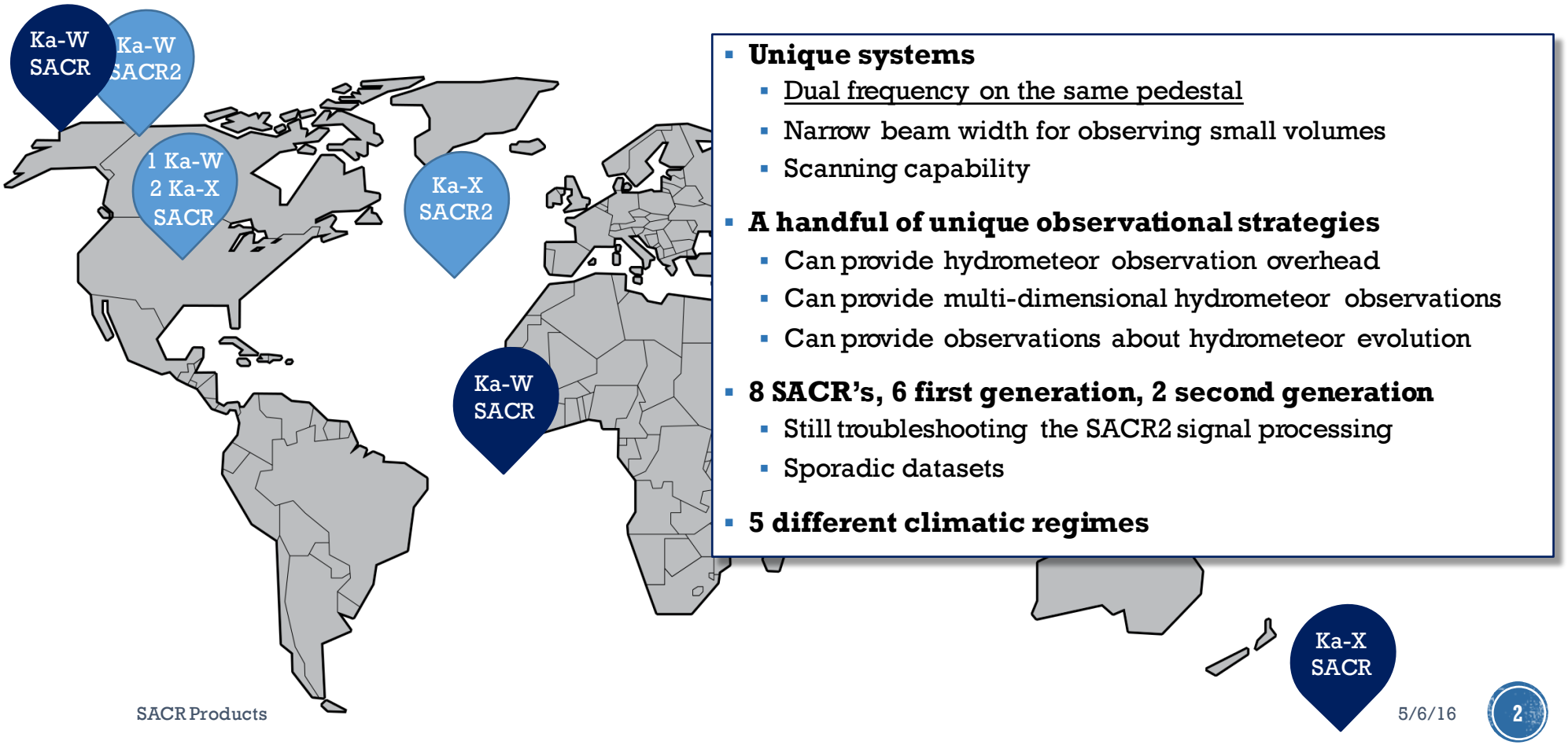
# SCANNING ARM CLOUD RADARS [SACR]



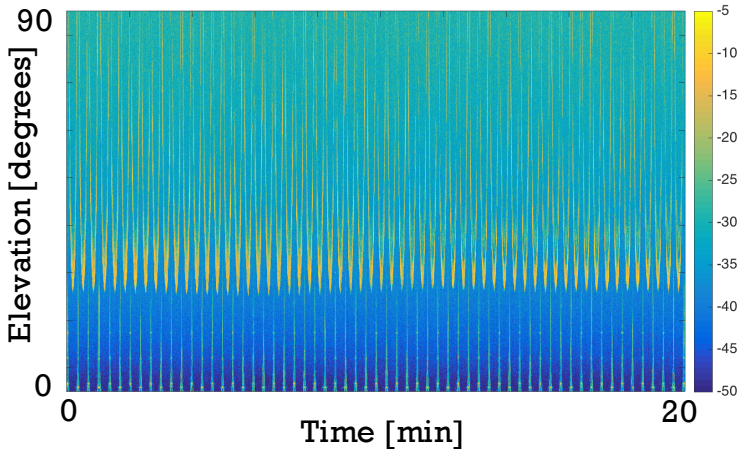

- **Unique systems**
  - Dual frequency on the same pedestal
  - Narrow beam width for observing small volumes
  - Scanning capability
- **A handful of unique observational strategies**
  - Can provide hydrometeor observation overhead
  - Can provide multi-dimensional hydrometeor observations
  - Can provide observations about hydrometeor evolution
- **8 SACR's, 6 first generation, 2 second generation**
  - Still troubleshooting the SACR2 signal processing
  - Sporadic datasets
- **5 different climatic regimes**

# CURRENT - SACRCORR

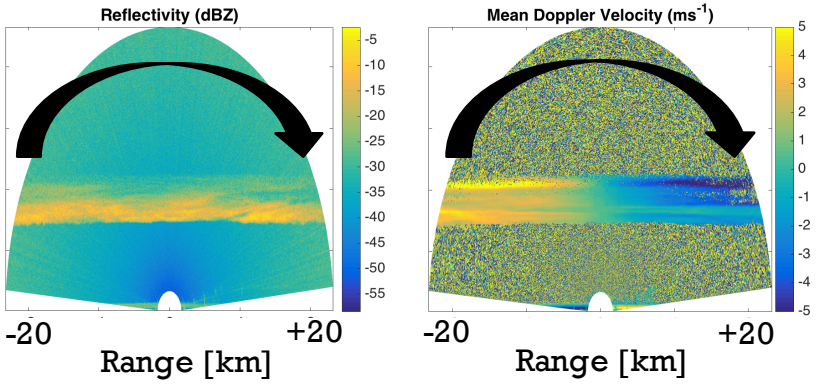
**Components:**

- Separate scans
- Isolate hydrometeors from noise
- Correct for gas attenuation
- Correct extreme velocities

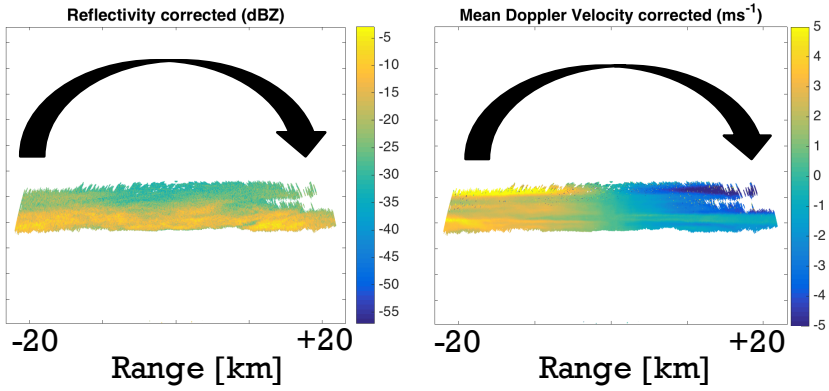
SACR a1. data – Time, elevation coordinates:
Collection of multiple horizon-to-horizon scans




SACR a1. data – Range, elevation coordinates:
A single horizon-to-horizon scans




SACRCORR b1. data – Range, elevation coordinates:
A single horizon-to-horizon scans

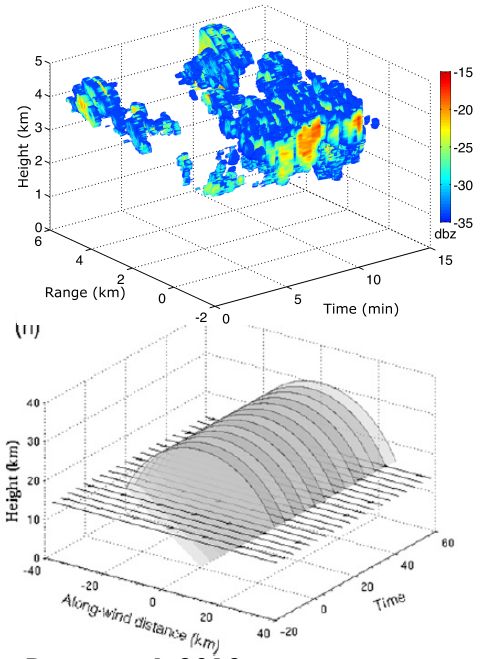



*Kollias et al. 2014*

*Thanks to Helmus for running the algorithm on this case*

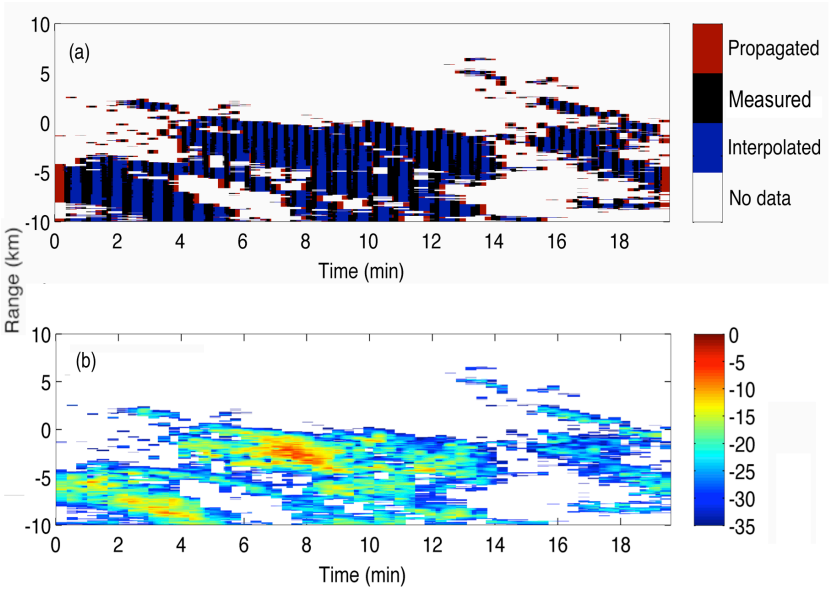
# POSSIBLE – GRIDDED SACRCORR

Pseudo 3-D reconstruction




*Berg et al. 2016*

Reconstruct observations at constant height




*Lamer et al. 2014*

**Components:**

- Cartesian grid
- Separate scans
- Isolate hydrometeors from noise
- Correct for gas attenuation
- Correct extreme velocities

**Value-added:**

- Easily access observation at constant height
- Complete 3-D view of individual clouds
  - Cumulus life cycle studies?
  - Entrainment studies?
  - Radiation studies

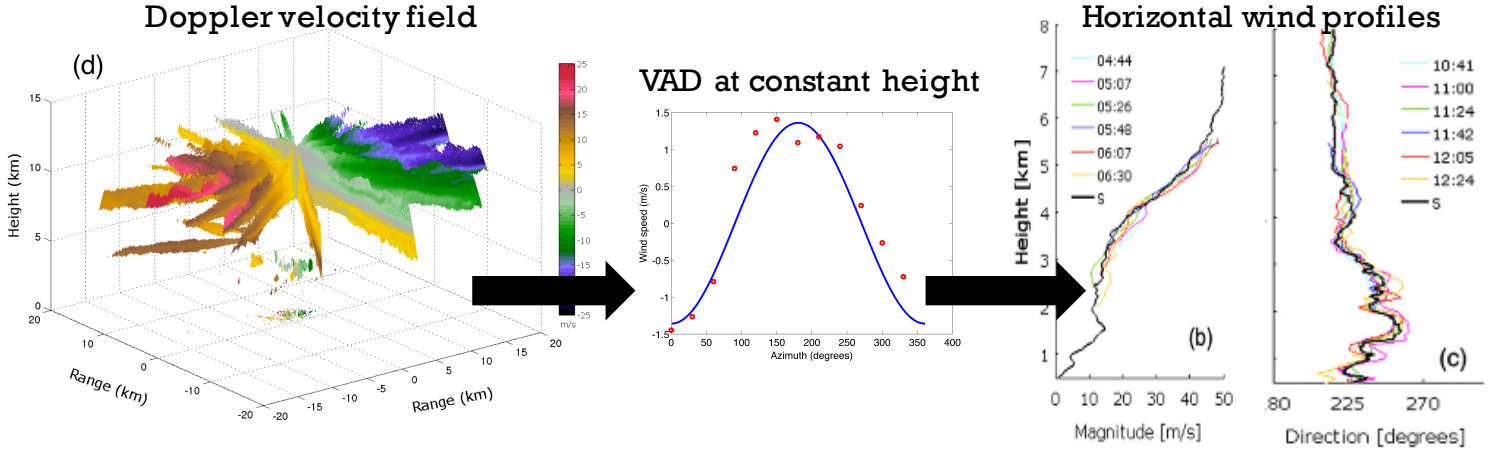
# POSSIBLE – HORIZONTAL WIND PROFILES

**Components:**

- Horizontal wind profile

**Value-added:**

- Complement infrequent soundings
- Useful for
  - Turbulence studies?
  - Estimating advection?
  - Estimating chord length?




*Kollias et al. (2014)*

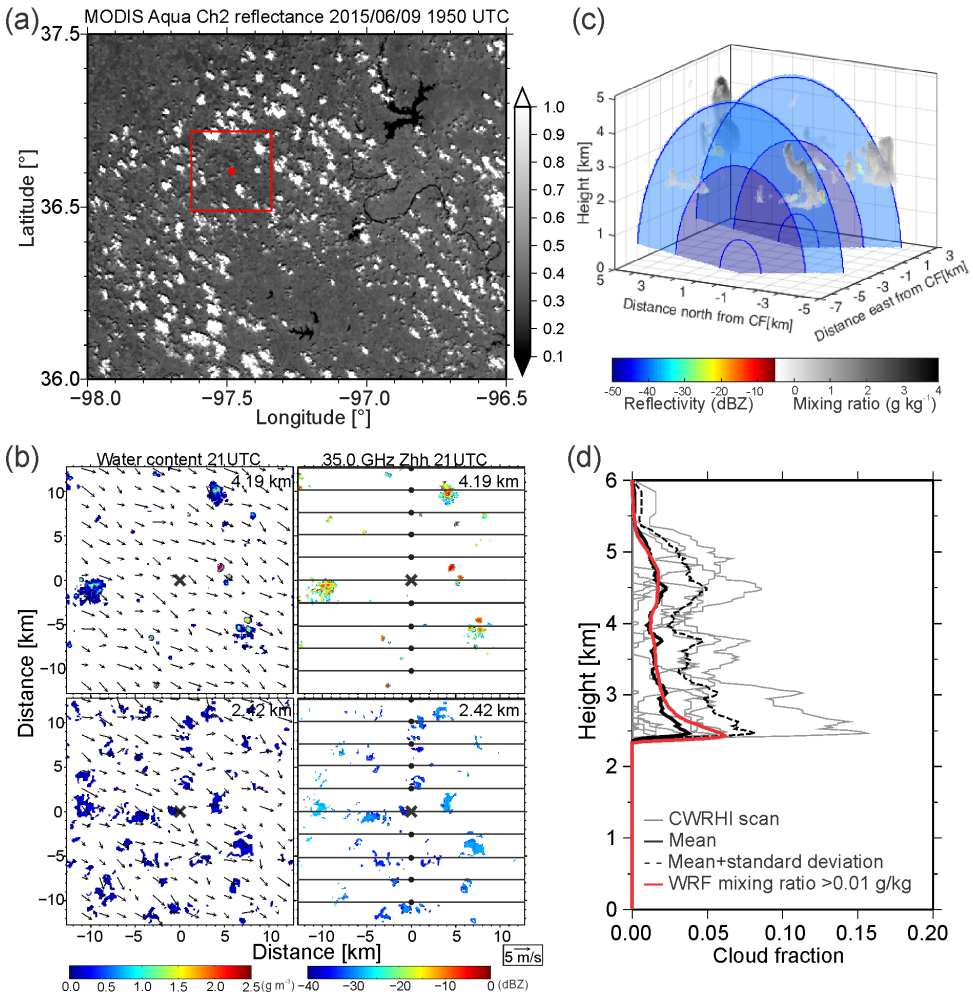
# POSSIBLE – DOMAIN BEST ESTIMATE CLOUD FIELD CHARACTERISTICS

**Components:**

- Cloud fraction
- Cloud type
- Cloud sizes

**Value-added:**

- Capture domain variability
- Familiar values
  - Convective organization?
  - Model evaluation?




*Oue et al. (2016)*

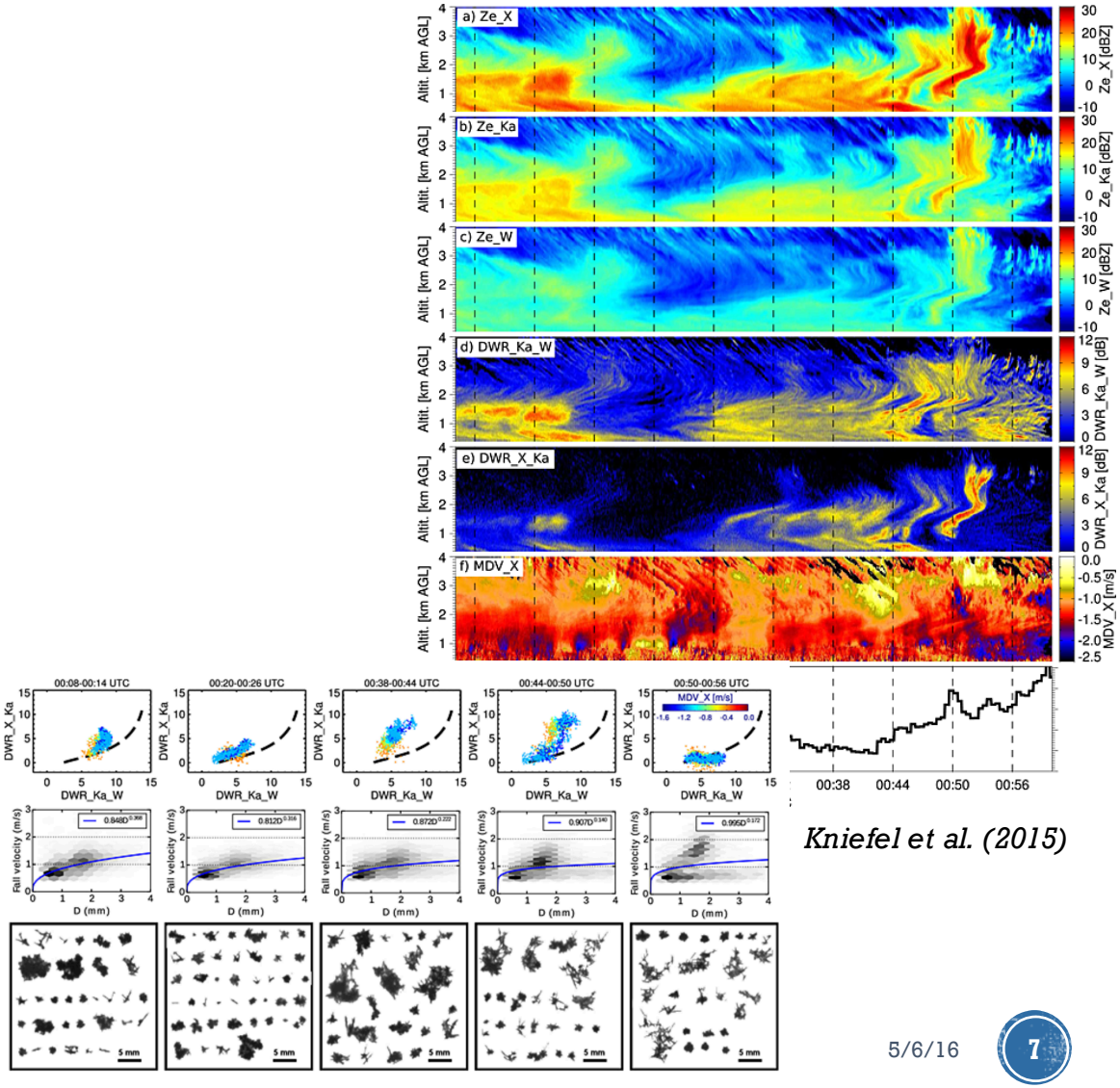
# POSSIBLE – MULTI-WAVELENGTH PACKAGES

**Components:**

- Multiple wavelength in a single file
- On a common grid
- Dual-wavelength ratios

**Value-added:**

- Exploit the unique nature of SACRs
- Allow early diagnostic of miscalibration, mispointing…
- Drive engineering requirements for matched beamwidth and pulse length
  - Ice microphysics?
  - Warm rain microphysics?




*Kniefel et al. (2015)*

# SUMMARY

| Potential product | Value-added | Site | Scan mode | Interest level |
|---|---|---|---|---|
| Cartesian grid | • Easily access observation at constant height<br>• Complete 3-D view of individual clouds | | | |
| Horizontal wind profiles | • Complement soundings | | HS-RHI | |
| Domain best estimate cloud field characteristics | • Captures domain variability<br>• Facilitates radar and model intercompasion | | CW-RHI | |
| Multi-frequency package | • Exploits the unique multi-frequency nature of SACRs<br>• Encourages proper implementation of radar beam alignment and calibration | | | |
| Quasi vertacal profiles | • Summarize off-zenith polarimetry | | | |
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# RESOURCES

- radar.arm.gov – For radar operational status
- trello.com – For radar data quality
- plot.dmf.arm.gov/plotbrowser/ – For quicklooks
- http://www.archive.arm.gov/ – For data orders

- radar@arm.gov – For engineering questions

# SACR PUBLICATIONS


2013

1. Marchand, R., Mace, G. G., Hallar, A. G., McCubbin, I. B., Matrosov, S. Y., & Shupe, M. D. (2013). Enhanced radar backscattering due to oriented ice particles at 95 GHz during StormVEx. *Journal of Atmospheric and Oceanic Technology*, *30*(10), 2336-2351.
2. Lamer, K., Tatarevic, A., Jo, I., & Kollias, P. (2013). Evaluation of gridded Scanning ARM Cloud Radar reflectivity observations and vertical Doppler velocity retrievals. *Atmospheric Measurement Techniques Discussions*, *6*, 9579-9621.
3. Tridon, F., Battaglia, A., & Kollias, P. (2013). Disentangling Mie and attenuation effects in rain using a Ka-W dual-wavelength Doppler spectral ratio technique. *Geophysical Research Letters*, *40*(20), 5548-5552.

2014

4. Borque, P., Kollias, P., & Giangrande, S. (2014). First observations of tracking clouds using scanning ARM cloud radars. *Journal of Applied Meteorology and Climatology*, *53*(12), 2732-2746.
5. Kollias, P., Bharadwaj, N., Widener, K., Jo, I., & Johnson, K. (2014). Scanning ARM cloud radars. Part I: Operational sampling strategies. *Journal of Atmospheric and Oceanic Technology*, *31*(3), 569-582.
6. Kollias, P., Jo, I., Borque, P., Tatarevic, A., Lamer, K., Bharadwaj, N., ... & Clothiaux, E. E. (2014). Scanning ARM cloud radars. Part II: Data quality control and processing. *Journal of Atmospheric and Oceanic Technology*, *31*(3), 583-598.

2015

7. Kneifel, S., Lerber, A., Tiira, J., Moisseev, D., Kollias, P., & Leinonen, J. (2015). Observed relations between snowfall microphysics and triple-frequency radar measurements. *Journal of Geophysical Research: Atmospheres*.