Argonne NATIONAL LABORATORY

ARM radar status and products for MC3E

Remote sensing products to enable MC3E Science

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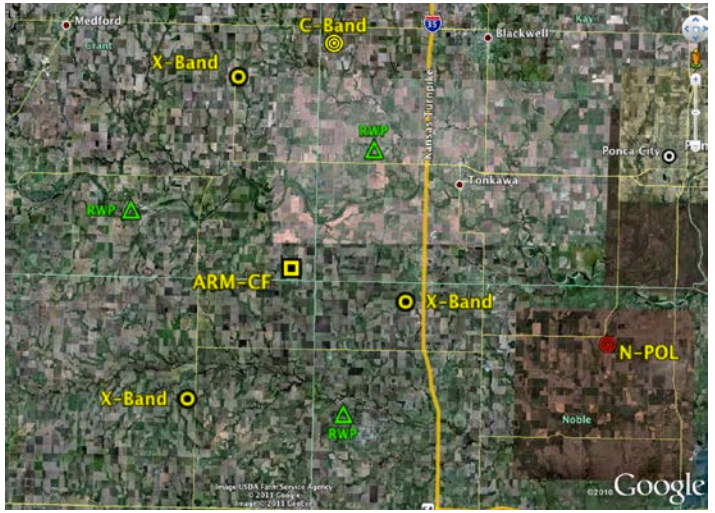
U.S. DEPARTMENT OF ENERGY

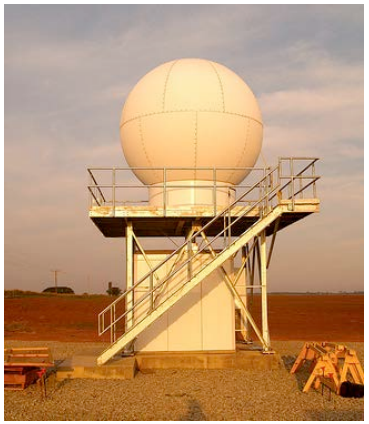
Out of the box science

- The ARRA procured radars had not been operating long before MC3E.
- Four new polarimetric radars and associated support instrumentation including networking and realtime displays.
- The radars performed well, there were a few outages but the majority of convective systems were captured.
- Work of the radar mentors and ATSC was critical in mission success..

MC3E ARM radar network

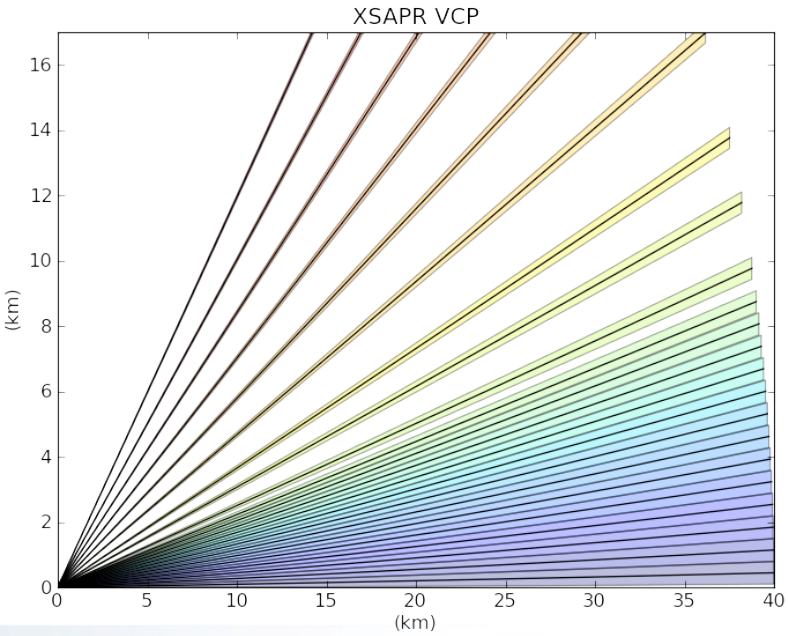
- Network of 4 intermediate facilities all focused on imaging the 20x20 box around the central facility where profiling and scanning cloud radars are located.
- Data in raw format (Sigmet and MDV) is available already on archive.arm.gov.
- The goal of the facility is to produce model like value added products from the scanning radar remotely sensed parameters.





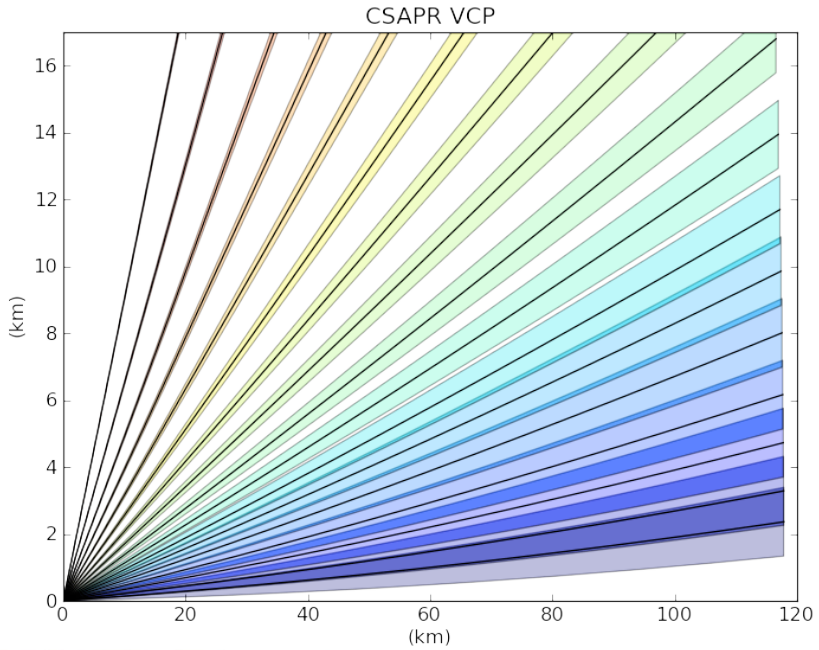
X-Band Scanning ARM Precipitation sensitive Radar

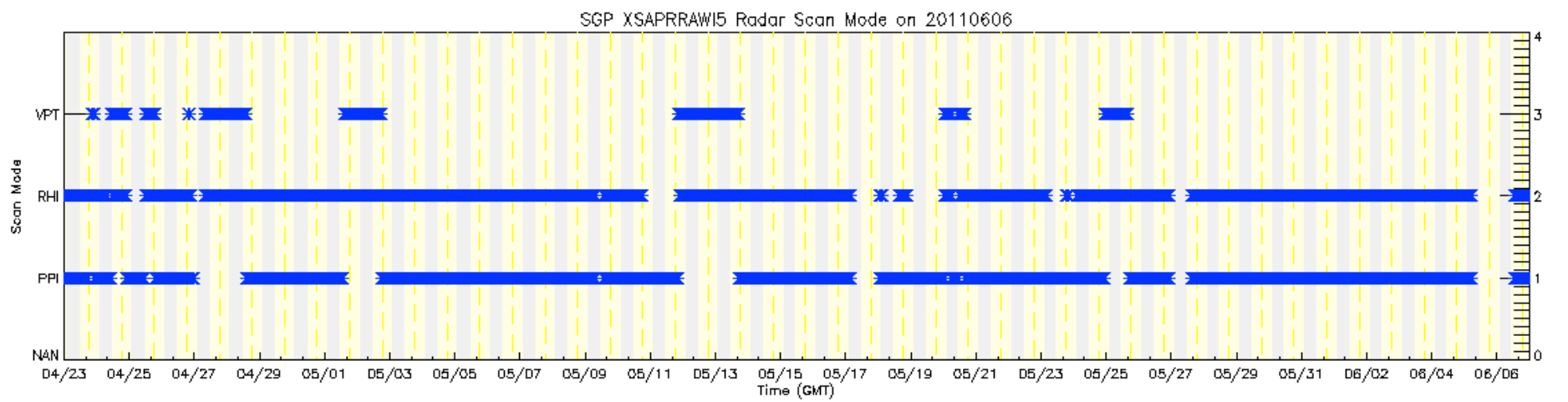
- We have a network of three polarimetric scanning X-Band systems.
- Three scanning modes:
  - 22 elevation angle deep convective
  - 10 elevation angle shallow/boundary
  - 6 azimuth horizon to horizon scans
  - Vertical dwell
- Maximum range of 40km
- Six minute volumes (in deep convective)
- Arranged to place the CF and three wind profilers in the multi-Doppler "sweet spots"
- Think of these as the "Storm Kinematic Sandbox"
- Also showing promise as a "gap bridging" radar for cloud studies



C-Band Scanning ARM Precipitation sensitive Radar

- We have a single polarimetric C-Band system located north west of the CF.
- Two scanning modes
  - 17 elevation angle volume
  - Single azimuth 0-90 degree scan over the CF
  - Vertical dwell
- Maximum range of 120km providing context for the X-Band network.
- Six minute volumes.
- Attenuation cross section at C-Band (5cm) much less than at X-Band making the C-SAPR the microphysical workhorse of the network.




SGP XSAPRRAWI5 Radar Scan Mode on 20110606
Scan Mode
VPT
RHI
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NAN
0
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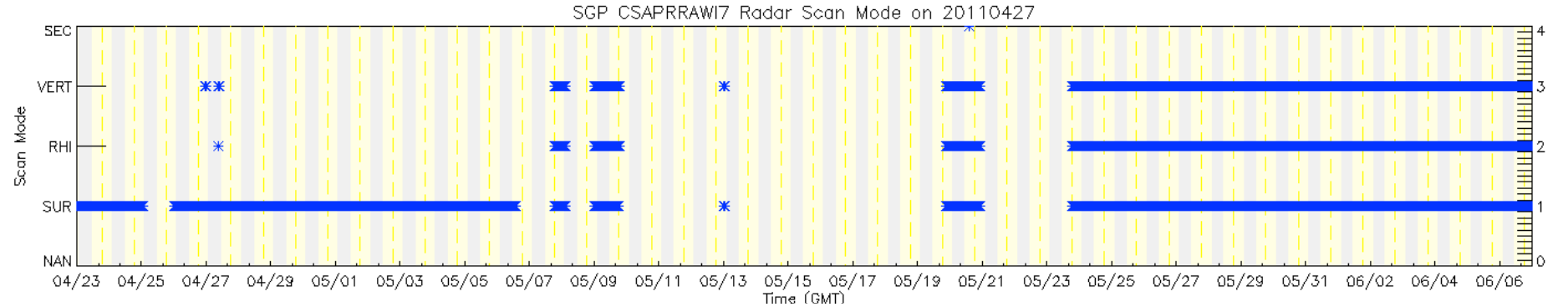
04/23 04/25 04/27 04/29 05/01 05/03 05/05 05/07 05/09 05/11 05/13 05/15 05/17 05/19 05/21 05/23 05/25 05/27 05/29 05/31 06/02 06/04 06/06
Time (GMT)


SGP CSAPRRAWI7 Radar Scan Mode on 20110427
Scan Mode
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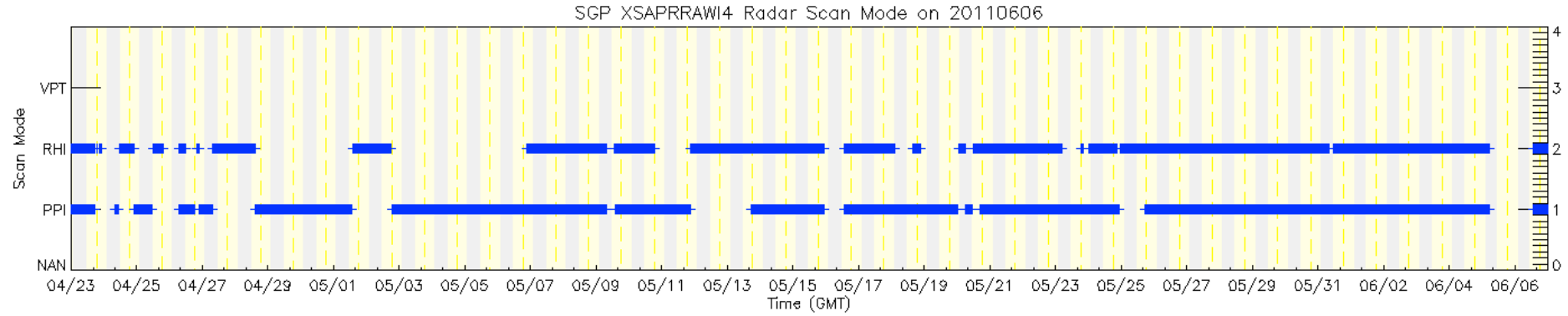
04/23 04/25 04/27 04/29 05/01 05/03 05/05 05/07 05/09 05/11 05/13 05/15 05/17 05/19 05/21 05/23 05/25 05/27 05/29 05/31 06/02 06/04 06/06
Time (GMT)


SGP XSAPRRAWI4 Radar Scan Mode on 20110606
Scan Mode
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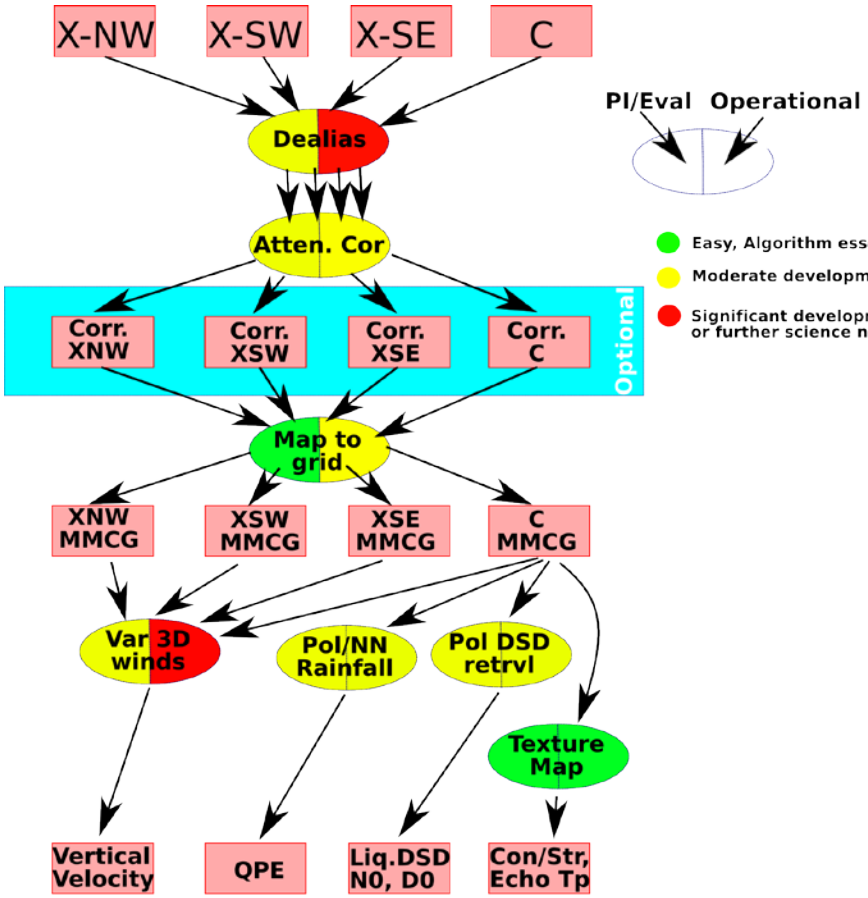
Time (GMT)

Radar VAPS for MC3E

- The SAPRs produce radial coordinate data in binary formats.
- This is not suitable for direct comparison with cloud and climate models.
- Based on feedback from the working groups we are constructing a retrieval framework.
- Some of this work involves the implementation of existing algorithms, most of it involves new R&D



Var 3D winds: Variational 3D wind retrievals

Pol DSD retrvl: Polarimetric Drop size retrieval in warm rain

Pol/NN Rainfall: Polarimetric or Neural Network based rainfall retrieval

Texture Map: Stiener based convective stratiform classification, echo top detection

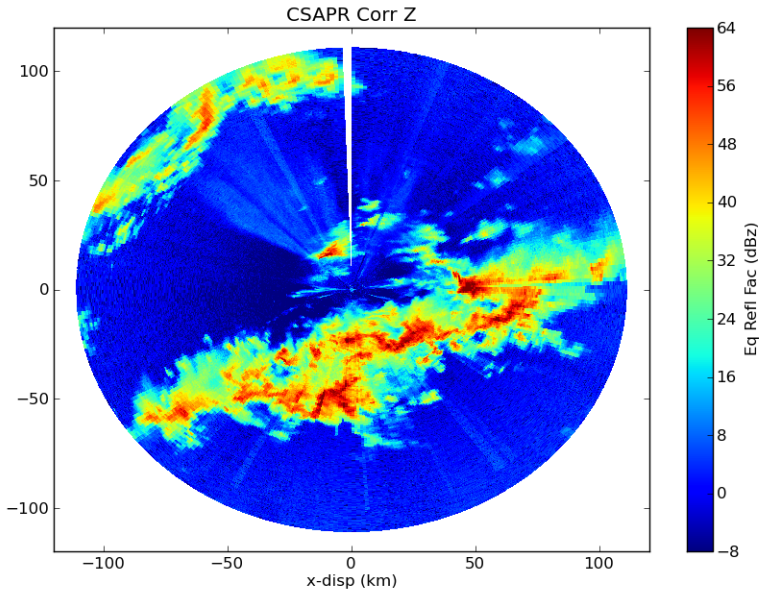
Map to grid: Balltree based Barnes filter

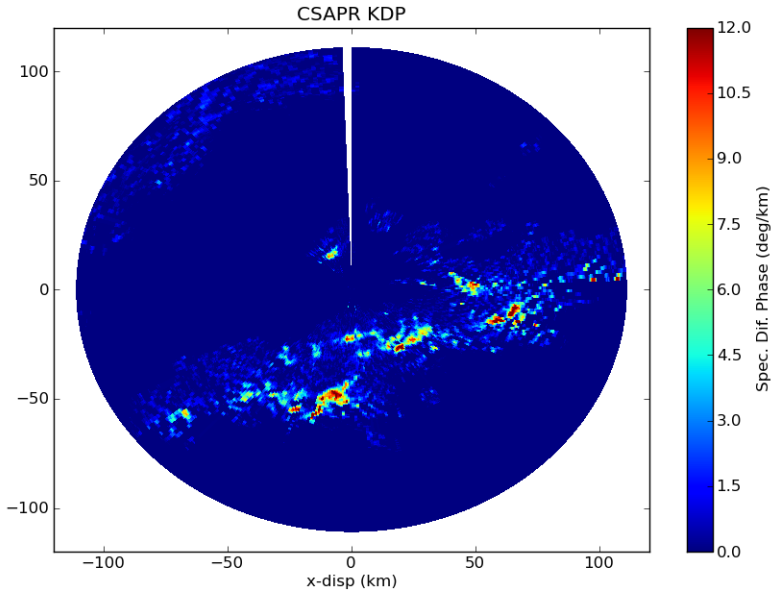
Dealias: U Washington 4DD velocity unfolding

Atten. Cor: PhiDP based attenuation and differential attenuation correction.

Corrected Moments in Antenna Coordinates

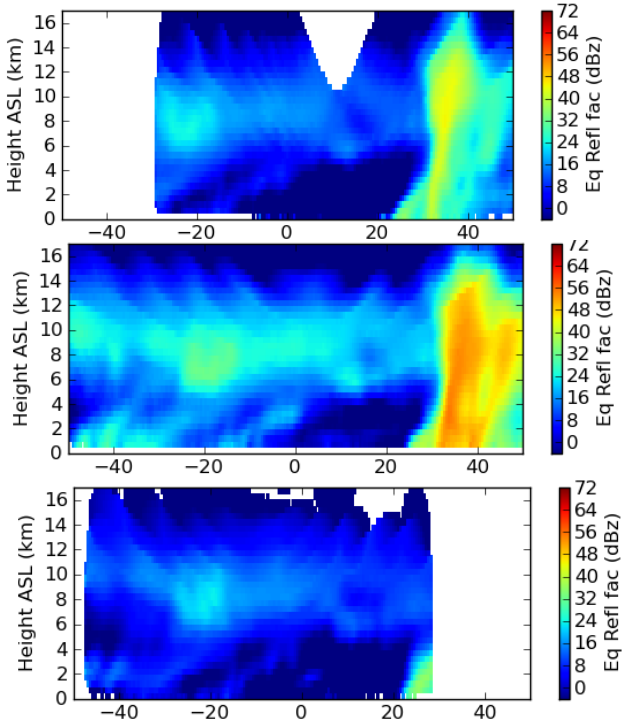
- Data in antenna coordinates is corrected for aliasing and phase folding.
- KDP is recalculated using a filter approach and a ZPHI (Bringi et al 2001 and Gu et al 2011) like attenuation correction algorithm is applied.
- Version 0.1Evaluation available for MC3E C-SAPR, soon to be available for X-SAPR.
- Active work on V1.0E which will include advanced phase processing.
- Format will be similar to SACR data as CF-Radial.

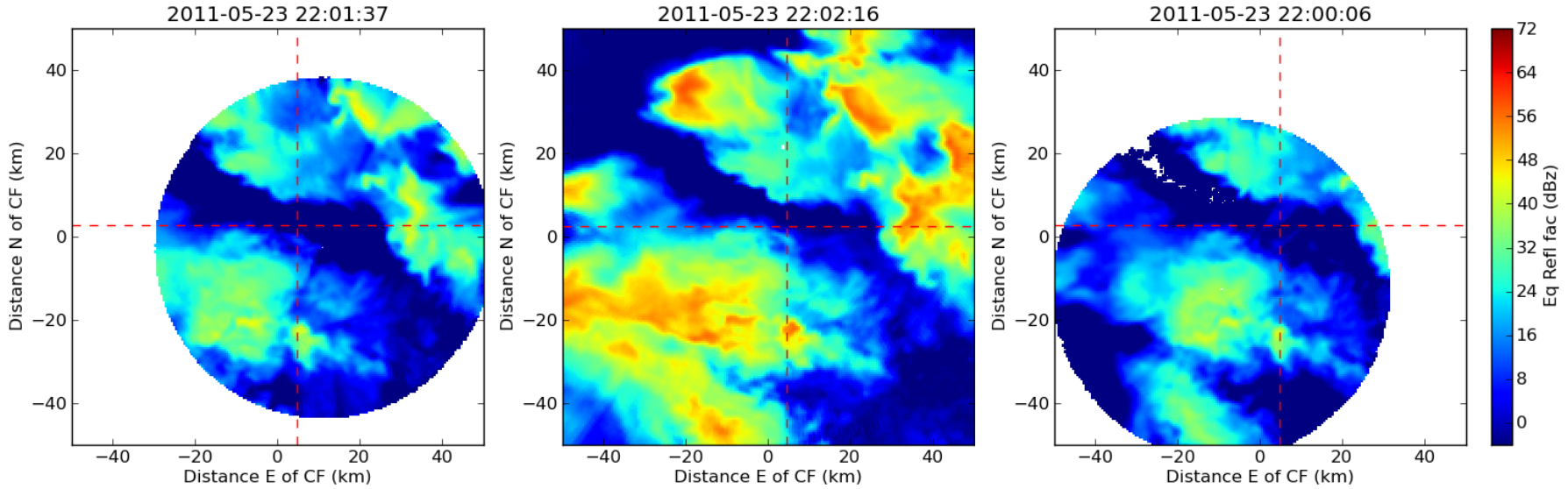




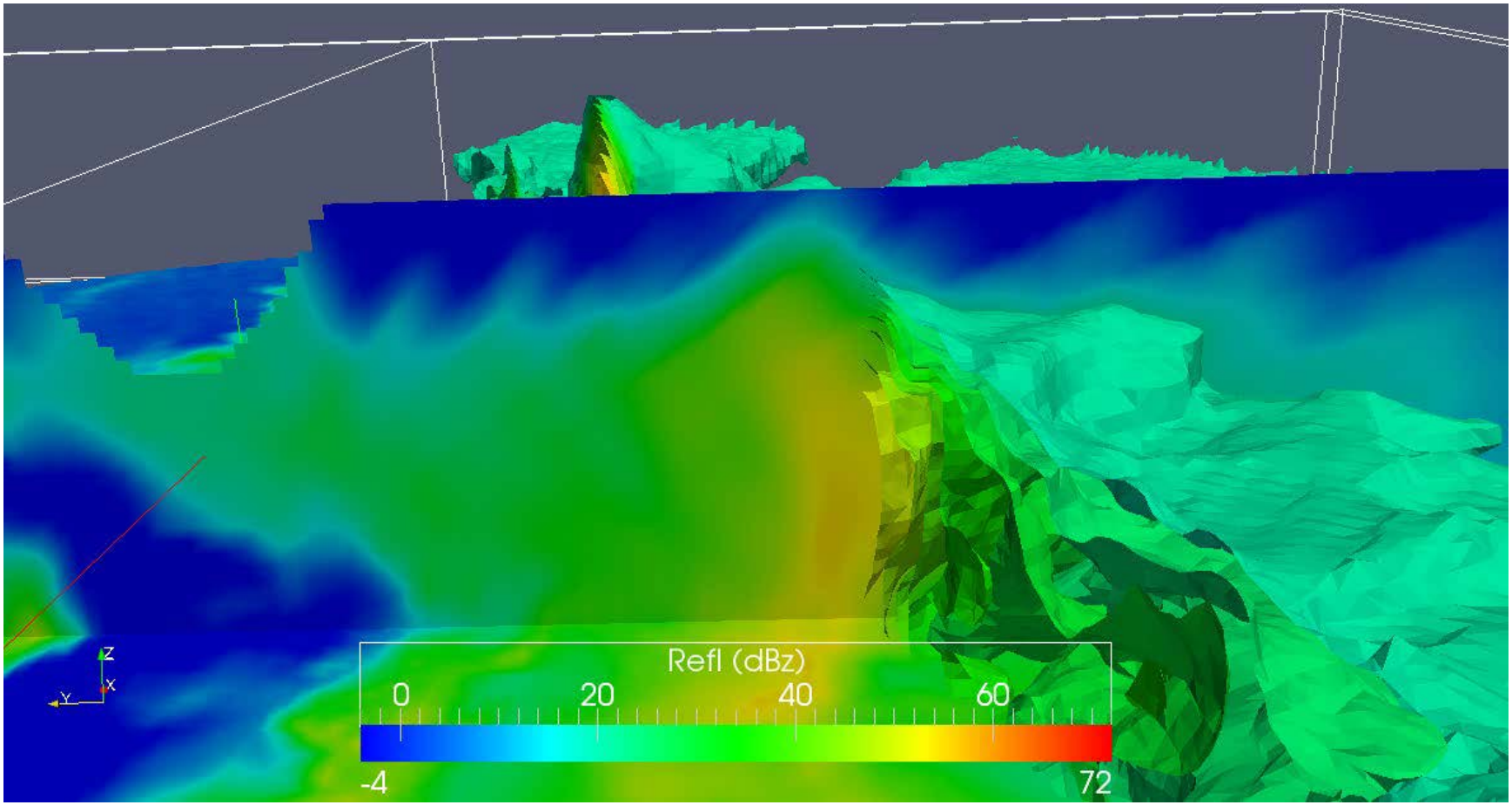
MMCG

- First VAP from the ARM radars.
- Mapped Moments to a Cartesian Grid.
- At the SGP this includes inner and outer grids.
- Outer grid is CSAPR on a 240x240kmx17km grid.
- Inner grid is all radars on a 100x100x17km grid.
- Frequency based on scan rate

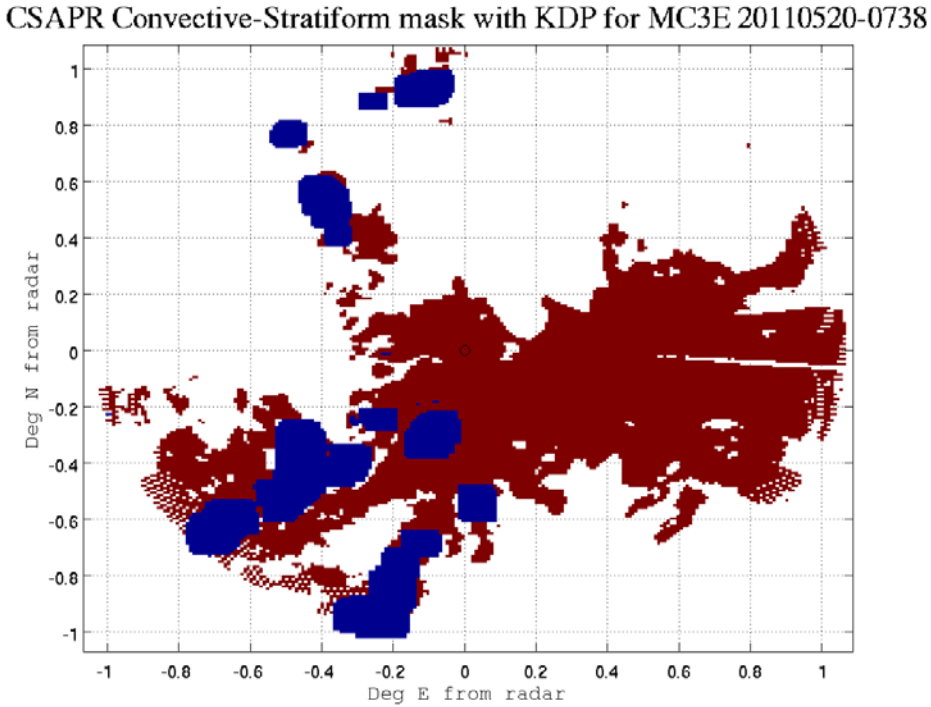


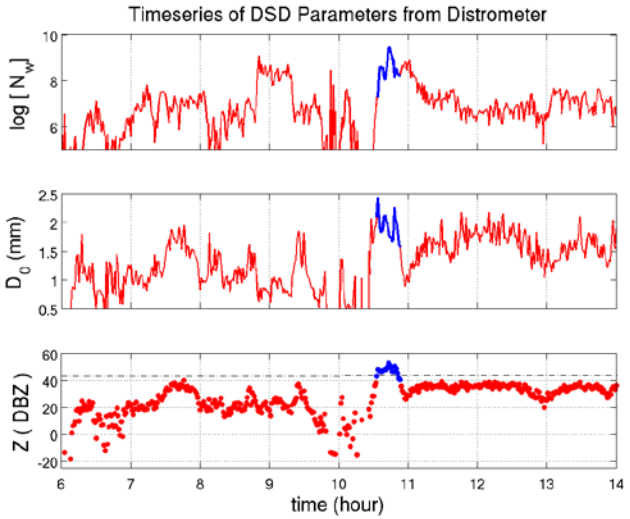


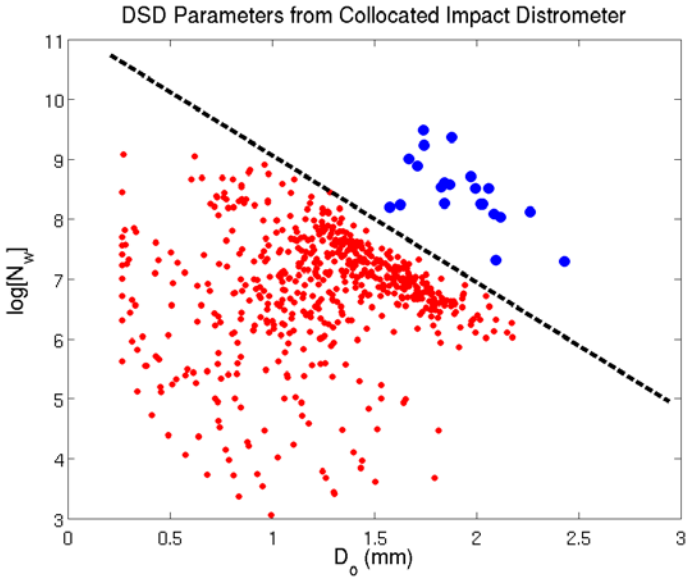
MMCG



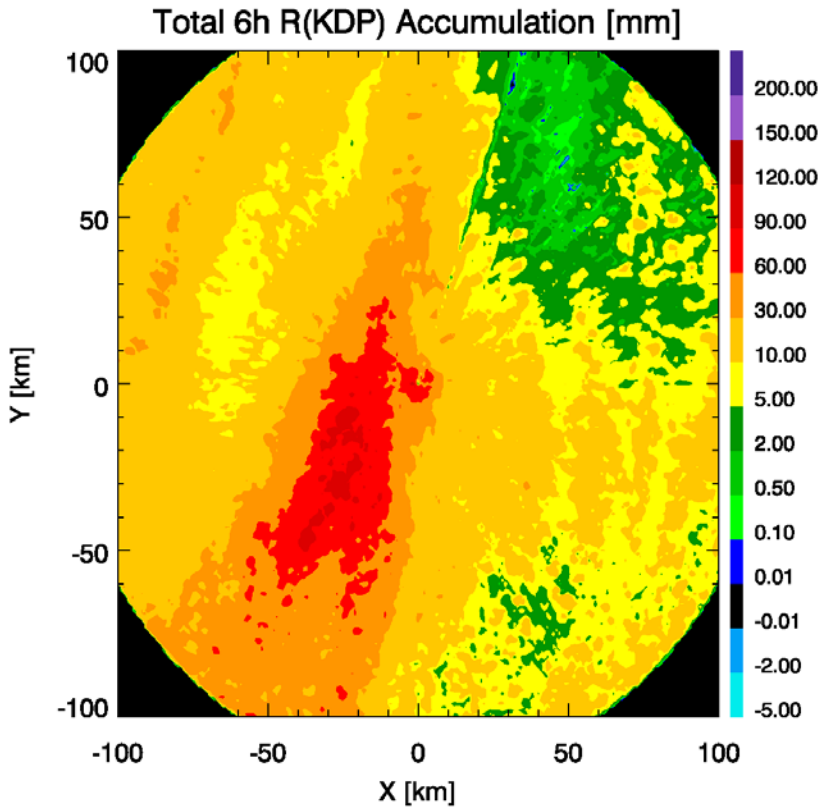
PI and Lab work on retrieval science: Convective classification

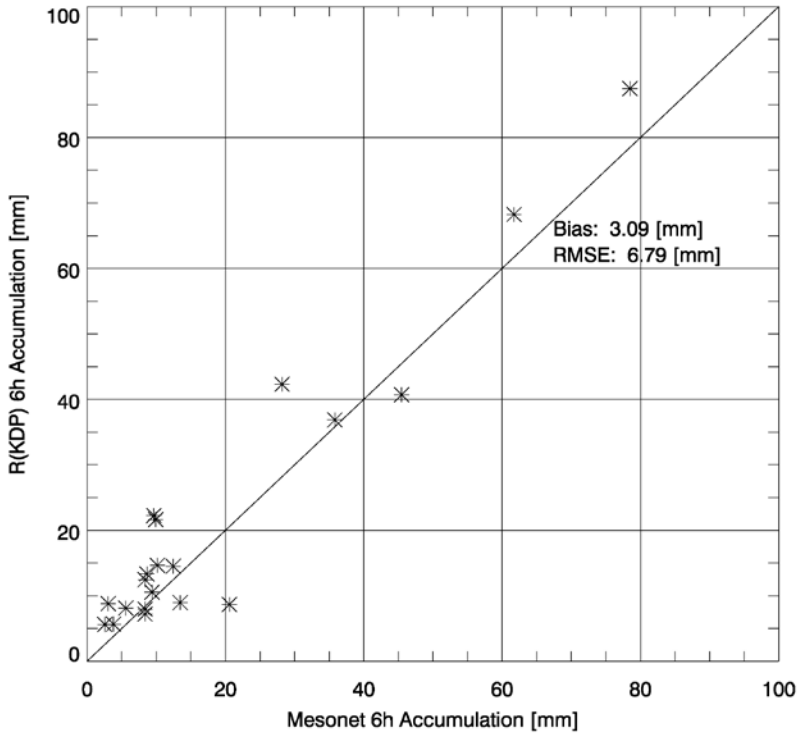






PI and Lab work on retrieval science: Polarimetric Rainfall

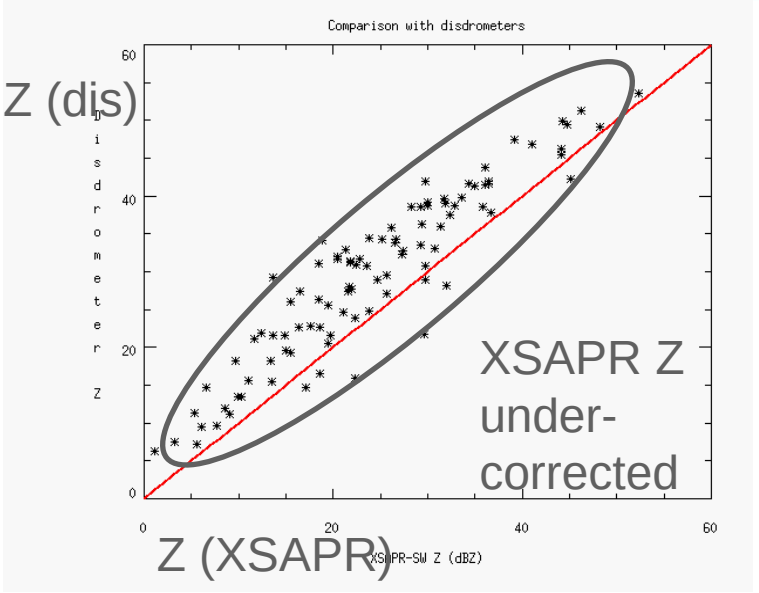


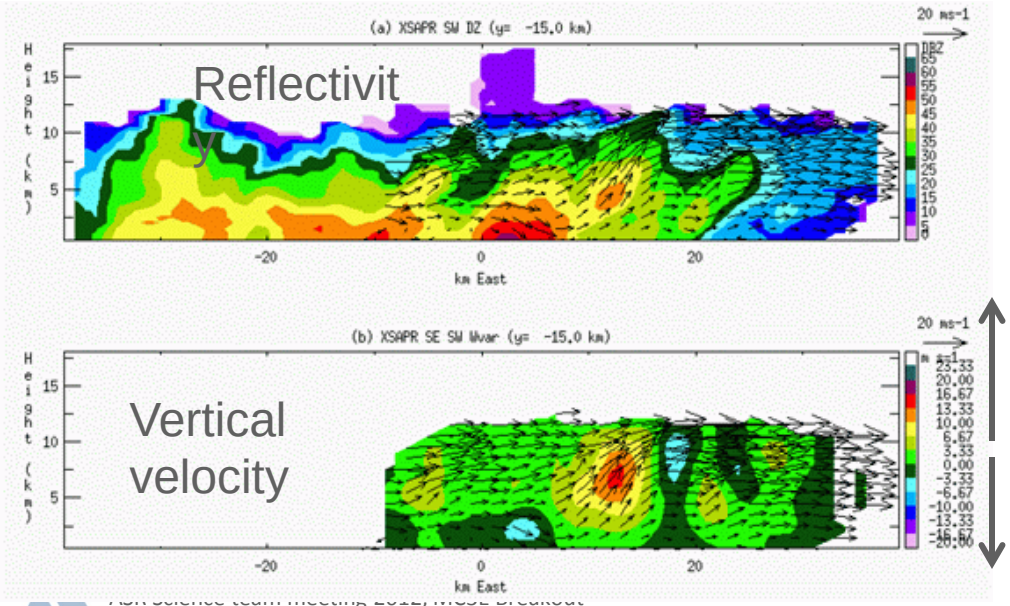


MC3E: X-SAPRs

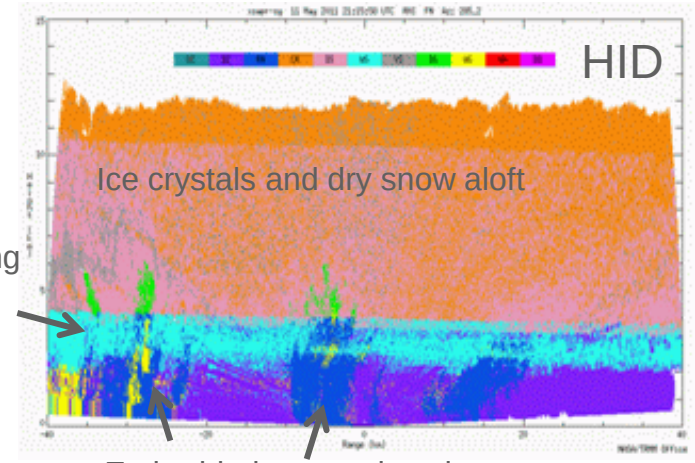
Angela Rowe, Brenda Dolan, Steven Rutledge (CSU)

- Quality control efforts
  - Identifying biases
  - Dealiasing velocity (by hand!)
  - Focus on attenuation correction (method based on Carey et al. 2000; in progress)
  - Comparisons with disdrometers, NPOL





- Analyses concentrating on vertical velocity, HID
  - Working toward dual-wavelength HID and rain estimation



PI and Lab work on retrieval science: Convective vertical velocities