Analysis of XSAPR and CSAPR data from MC3E

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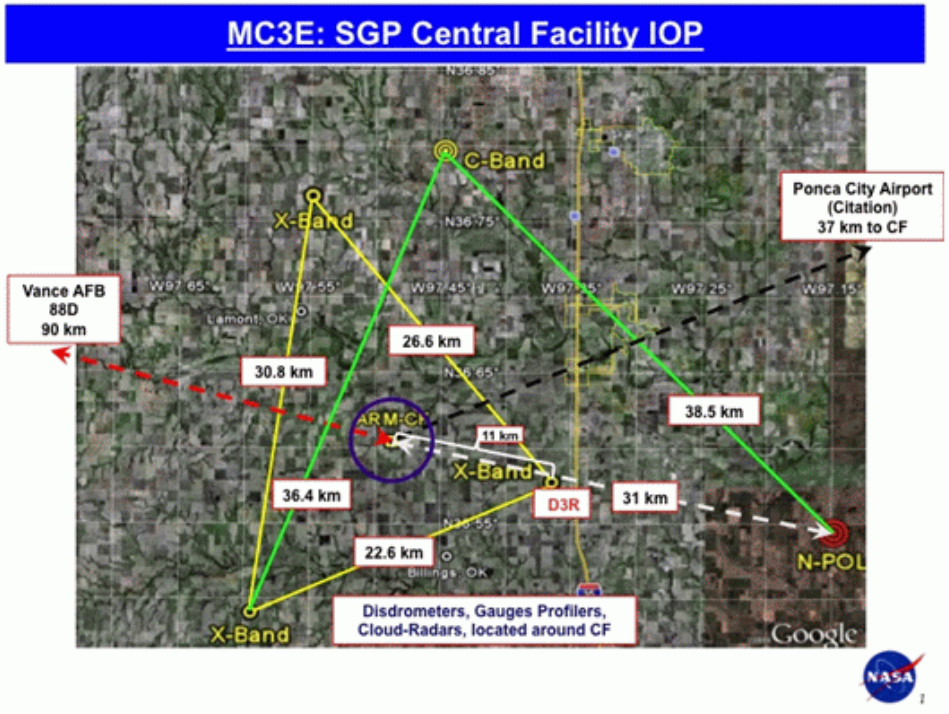
MC3E (DOE, NASA)

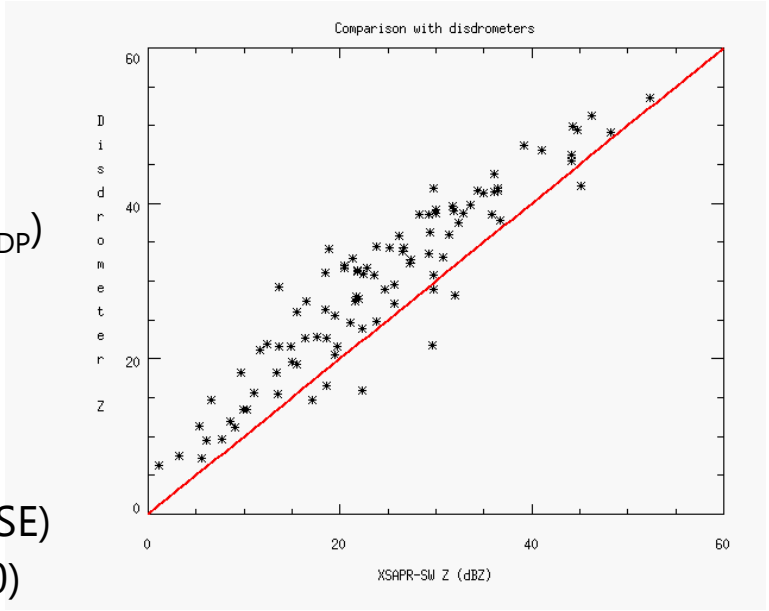
- April-June 2011
- Characterized convective systems and their environment
- Dual-polarimetric radar network
  - Three X-band (XSAPRs, ARM)
  - One C-band (CSAPR, ARM)
  - S-band (NPOL, NASA)

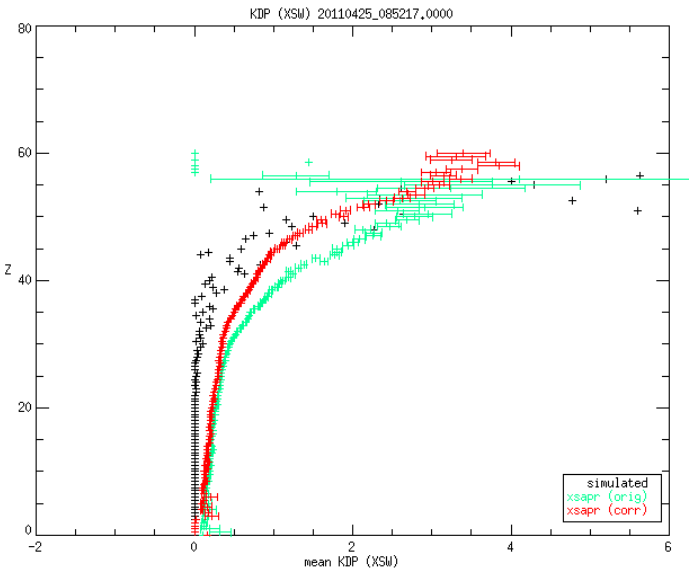


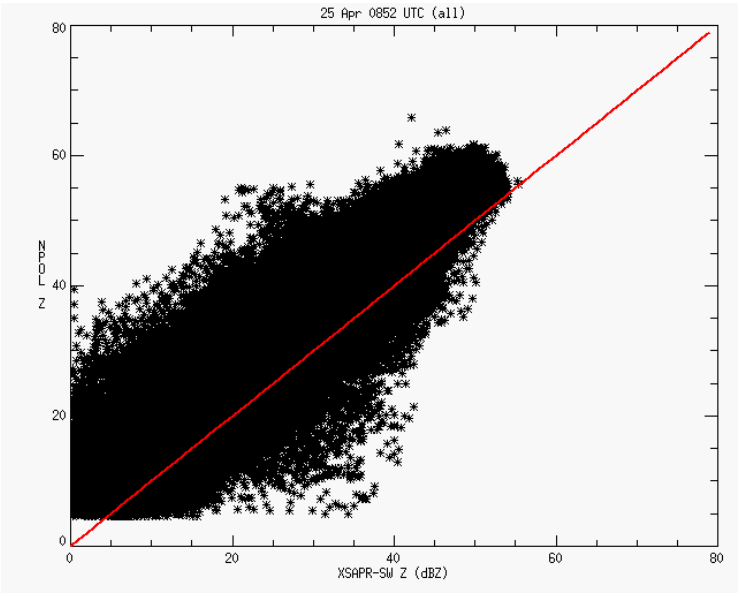
- Goal: Improve physical understanding of precipitating systems in support of ASR modeling efforts.

Quality control - XSAPR

- Phase folding (SE)
- Removal of non-meteorological echo (ρ_{HV} and SD(Φ_{DP}) thresholds)
- Used K_{DP} from raw files (Wang and Chandrasekar 2009)
- Unfolded velocities (by hand, multiple folds, Nyquist 17.2 and 16.8 ms^{-1} for SW and SE, respectively)
- Z_{DR} bias (vertically pointing): -3.6 dB (SW), +0.1 dB (SE)
- Phase-based attenuation corrected (Carey et al. 2000)
  - $Z_H(corr)=Z_H+a\Phi_{DP}$ $Z_{DR}(corr)=Z_{DR}+b\Phi_{DP}$

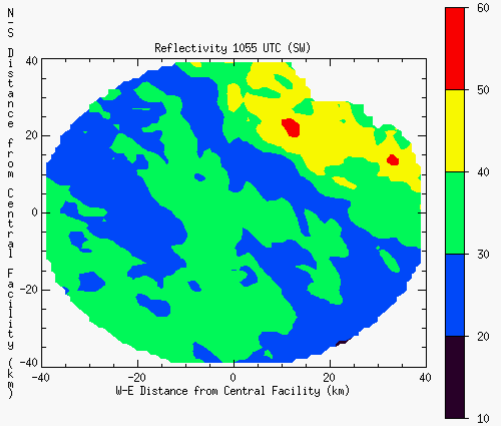


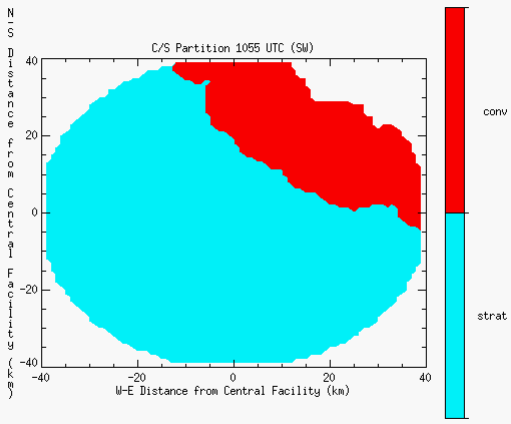


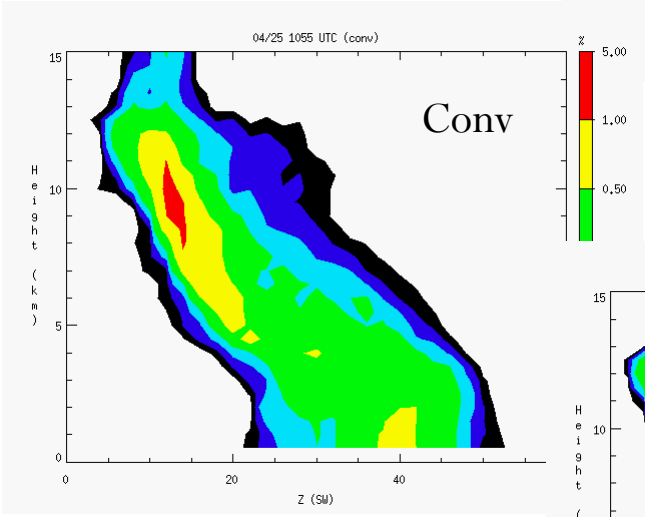


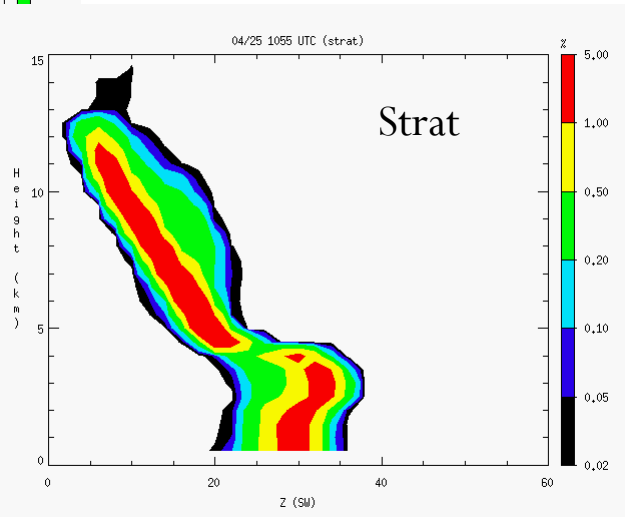
Convective/stratiform partitioning

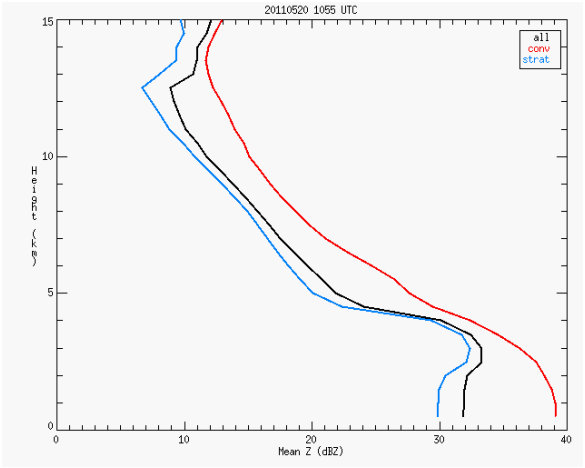
- Steiner et al. (1995
- Examples from 1055 UTC on 20 May 2011





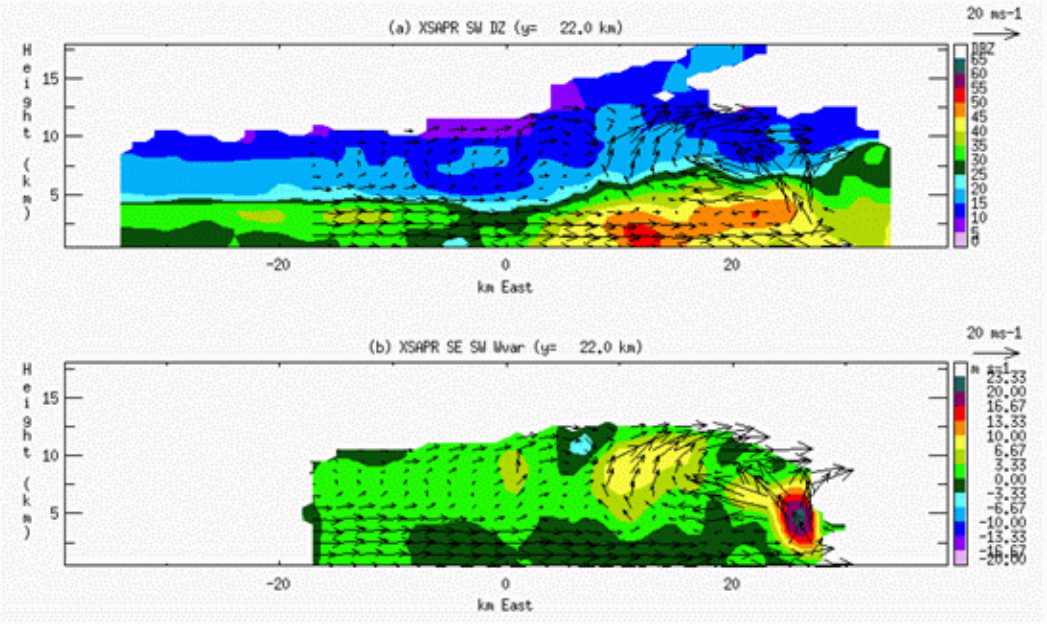


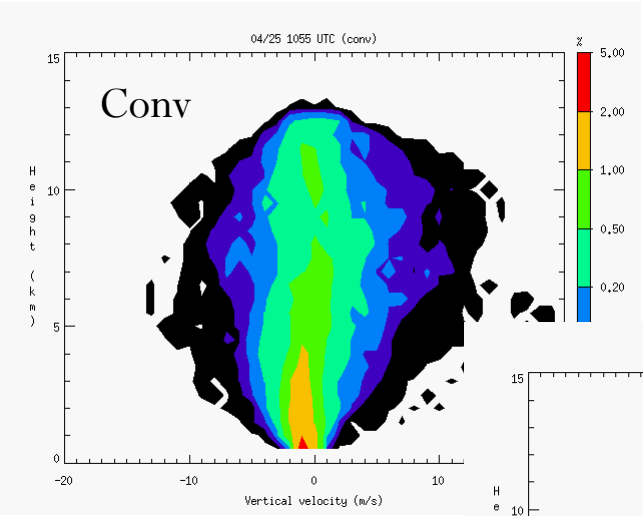


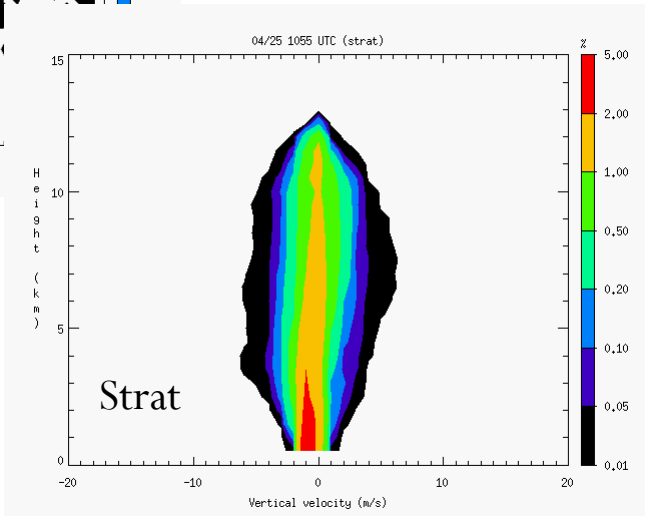


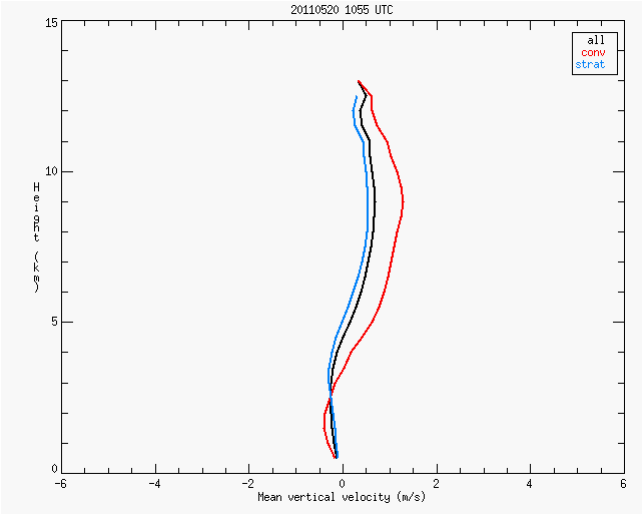
Vertical Velocity

- From dual-Doppler synthesis
  - XSAPRs – SW and SE
- Example from 20 May 2011 shows reasonable vertical velocities for both convective and trailing stratiform regions



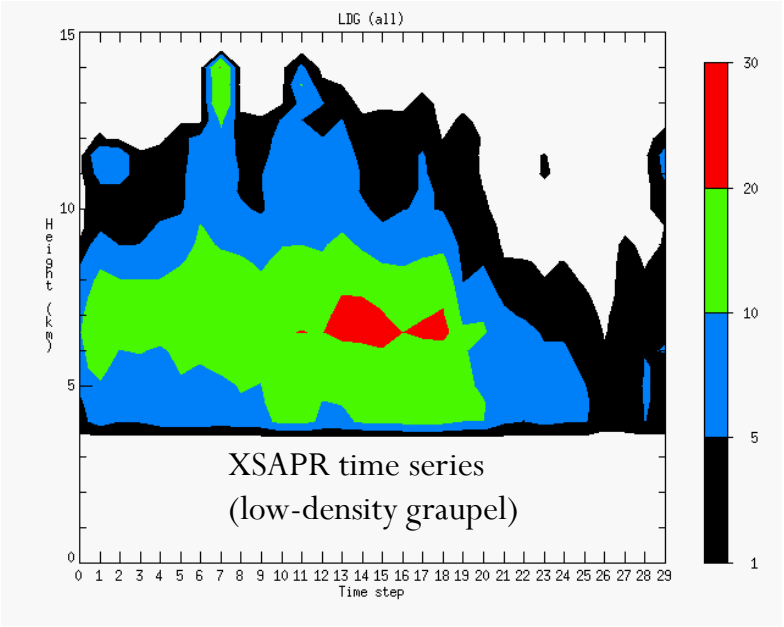


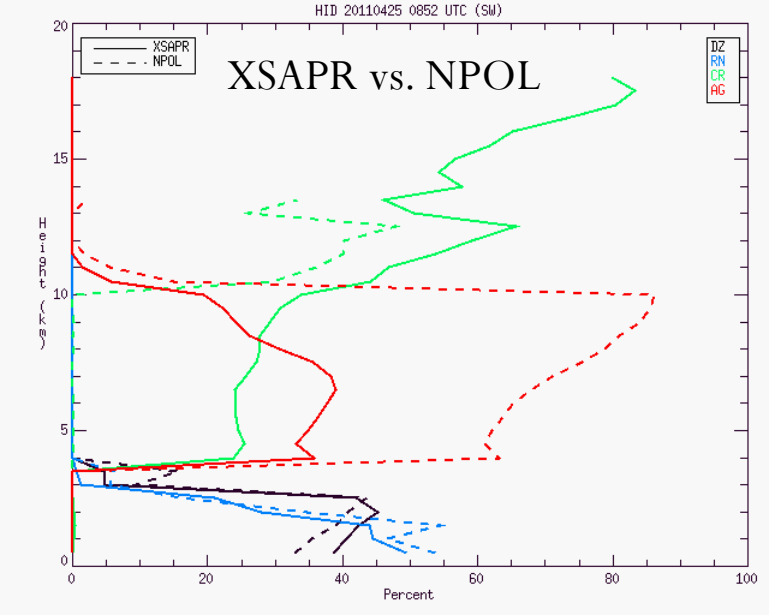


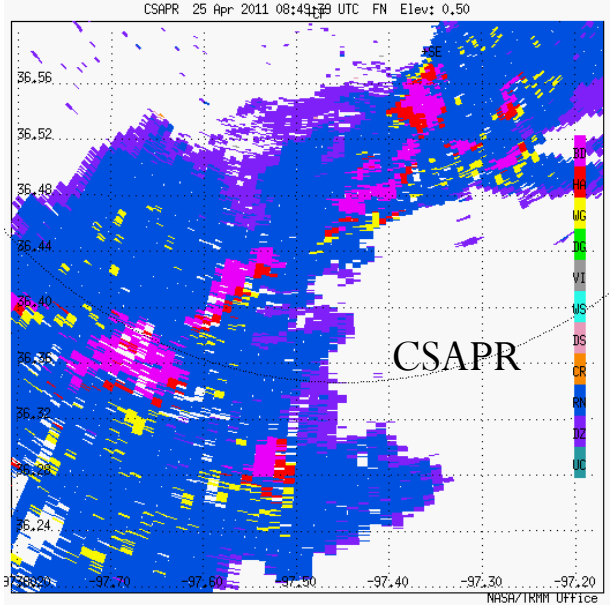


Hydrometeor Identification

- Method for X-band based on Dolan and Rutledge (2009)
  - Modified to include hail, wet snow, and big drops
- Will use CSAPR data to create a dual-wavelength product
  - Greater sensitivity to phase shift at X-band (ice crystals, winter systems)

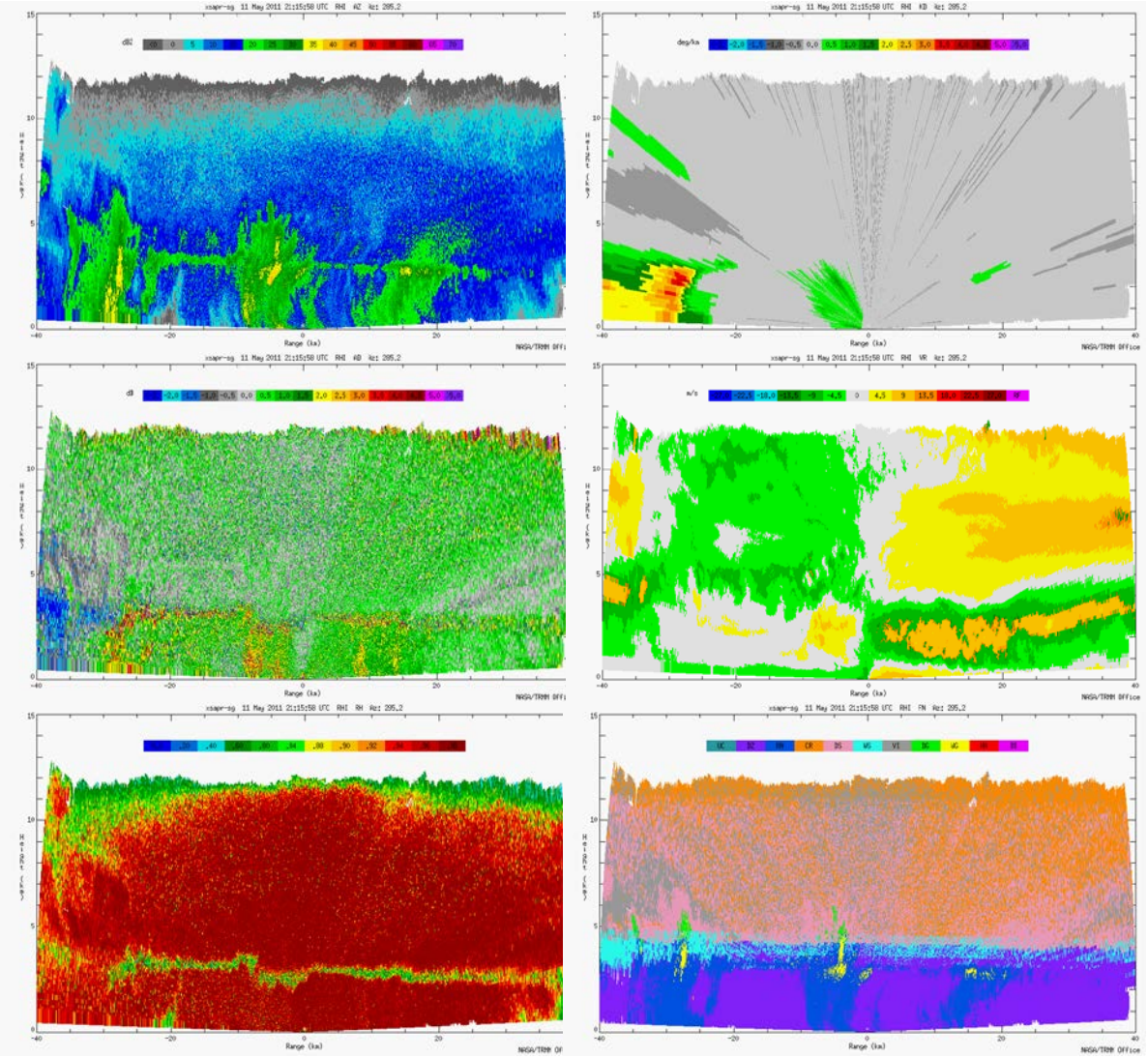






Additional analysis

- Horizon-to-horizon RHIs (XSAPR)
- D_0 retrieval difficult due to uncertainties in Z_{DR}
- Dual-wavelength rain products
- Additional MC3E cases, winter events



Thank you!

- What would you like to see?