Goal - To understand the evolution/lifecycle of cirrus anvils

- **Role of mesoscale processes**
  - Deep convection microphysical input/outflow
  - Ambient environmental conditions
  - Convection-induced circulations

- **Role of cloud-scale processes**
  - Particle sedimentation
  - Cloud-scale circulations
  - New particle generation/growth?
  - Radiative processes

=> Impact on Radiative and UT Humidity fields
July 23rd Extended Anvil Case

Approach - Conduct high-resolution simulations of cirrus lifecycle

Tool - Cloud-resolving model w/ resolved ice microphysics, R.-F. Lin
   (2-D model with 100-m resolution and bin microphysics/aerosol)

Validating Data - Cloud Ice Field
   CRS (G.Heymsfield, L.Li, Z.Wang) ……no COSSIR
   In-situ (A.Heymsfield and the Cloud Probers)

Validating Data - Cloud Dynamics
   In-situ (B.Demoz, P.Bui, M.Poellot)

Validating Data - Cloud Optical Properties
   CPL (M.McGill, D.Hlavka, W.Hart)
   PDL (K.Sassen)
   MAS/MODIS (S.Platnick, M.King)
   GOES (P.Minnis et al)
July 23rd Extended Anvil Case

Initializing Data

**Cloud Ice Field**
- CRS and EDOP (G. Heymsfield, L. Li, Z. Wang, L. Tian)
- MM5 (R. F.-Lin, Y. Wang, A. Lare)
- In-situ (A. Heymsfield and the Cloud Probers)

**Environmental Data**
- NWS, CFU, PARCL, and ER-2 soundings (J. Halverson, L. Miloshevich, B. Demoz, A. Lare)
- MM5 and NWS Eta (R.-F. Lin, Y. Wang, A. Lare)
- In-situ (B. Demoz, P. Bui, M. Poellot)
- Meteorology/NEXRAD (J. Halverson, T. Rickenbach, A. Lare)
July 23rd: NEXRAD, 1700-2000 UTC

1700 UTC

1800 UTC

1900 UTC

2000 UTC
July 23rd: NEXRAD, 2000-2300 UTC
July 23rd: CPL, CRS, NEXRAD and EDOP: 20 UTC
July 23rd: CPL, CRS, NEXRAD and EDOP: 21 UTC
July 23rd: CPL, CRS, NEXRAD and EDOP: 22 UTC
July 23rd: CPL, CRS, NEXRAD and EDOP: 23 UTC
July 23rd: NEXRAD, 2000-2300 UTC

2000 UTC

2100 UTC

2200 UTC

2300 UTC

Contour: dBZ DPR at 5 km (every 10 dBZ starting at 0)

Image: dBZ DPR at 2 km
July 23rd: MM5 Precipitation

2030 UTC

2130 UTC

2230 UTC

2330 UTC
July 23rd: MM5 Upper Air with Cloud Ice

2000 UTC

2100 UTC

2200 UTC

2300 UTC

Starr/GSFC
July 23rd: MM5 30-210° Cross-Section, 2300 UTC

[Graph showing RH (%) and cloud coverage]
July 23rd: MM5 30-210° Cross-Section, 2300 UTC
July 23rd: Mobile and PARCL Soundings
July 23rd: CRM Cloud Ice Field

1st CRM of 23rd July - Pure Sedimentation
Initial Cloud Ice from MM5, 12-15 km

Starr/GSFC
July 23rd: Cloud Water from CRS-CPL-EDOP
July 23rd: Cloud Optical Depth from CPL

CPL High Cloud Optical Depth for 532nm

Layer Optical Depth

Time of Day (UTC)

CPL High Cloud Optical Depth for 532nm

Layer Optical Depth

Time of Day (UTC)
Next Steps

• Integrate Cloud Water information to estimate Initial Conditions and Time/Space-Dependent Evolution, specifically IWC(x,t) and N_r(x,t)

• Complete Analysis of MM5, Eta, and Sonde data to Characterize Environment

• Iterate 2-D Simulations to Achieve “Best” Result => Microphysical Consistency

• Compare CRM Cloud-scale Dynamics to *in-situ* Observations (WB-57, Citation)

• Compare CRM Cloud Optical Properties to Observations (CPL, MAS, GOES)

• Evaluate Importance of Mesoscale Circulations (Buoyancy Waves) using CRM

• More Cases............
  July 28th Case Study
  July 29th Case Study
  July 16th Case Study