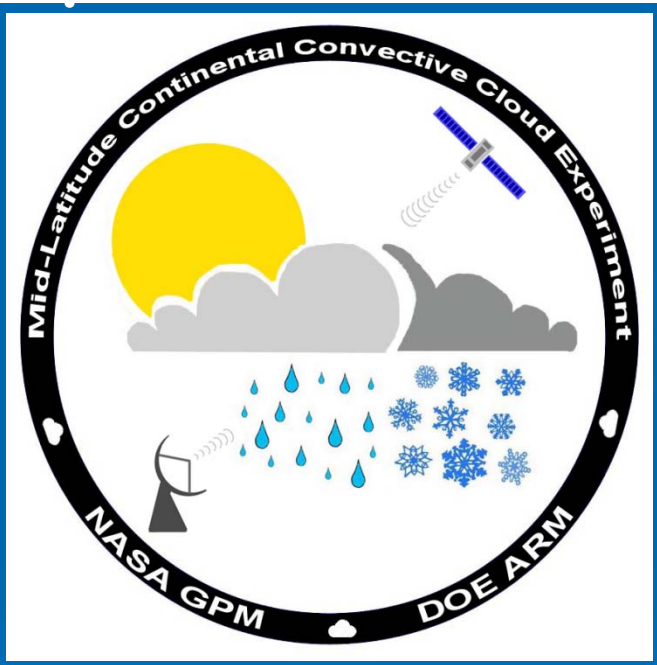
DOE – ARM / NASA- GPM

Midlatitude Continental Convective Cloud Experiment (MC3E)

- SGP
- April – May 2011



Michael Jensen (BNL), Walt Petersen (NASA MSFC)

ASR Cloud, Aerosol, Precipitation Interactions WG mtg.

Boulder, CO

MC3E April 15 – May 31, DOE ARM Central Facility

Represents a collaborative effort between the DOE ARM Program and the NASA Global Precipitation Measurement (GPM) mission

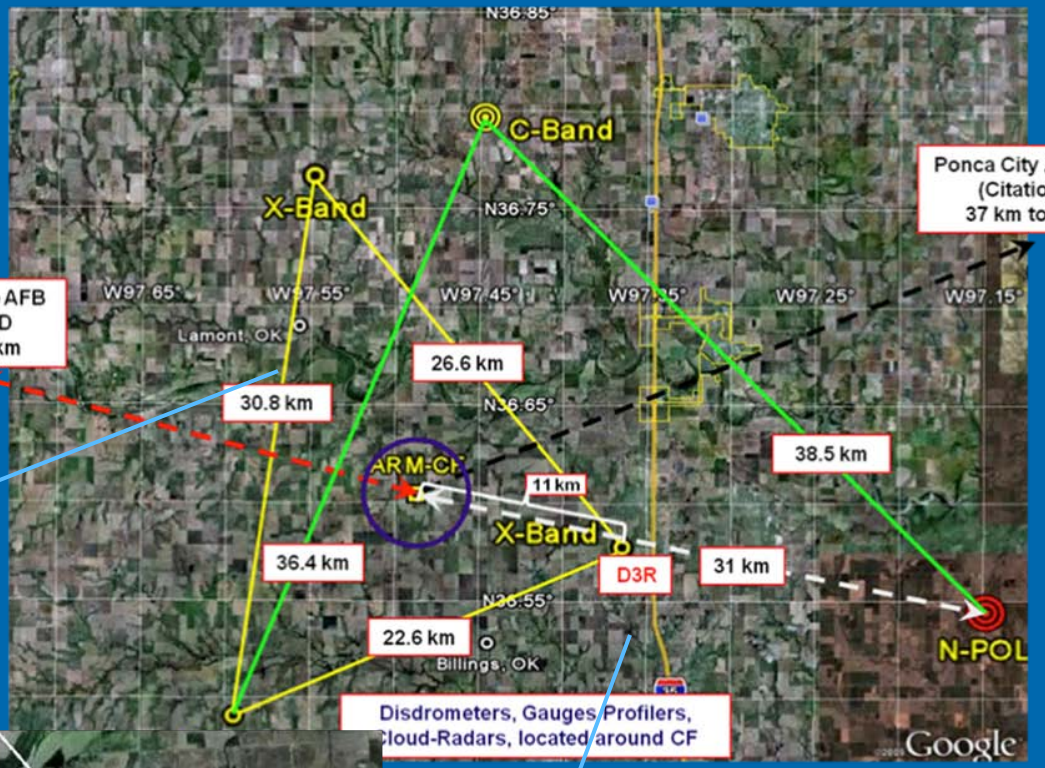
Overarching Science:
A complete characterization of convective cloud systems in order to:

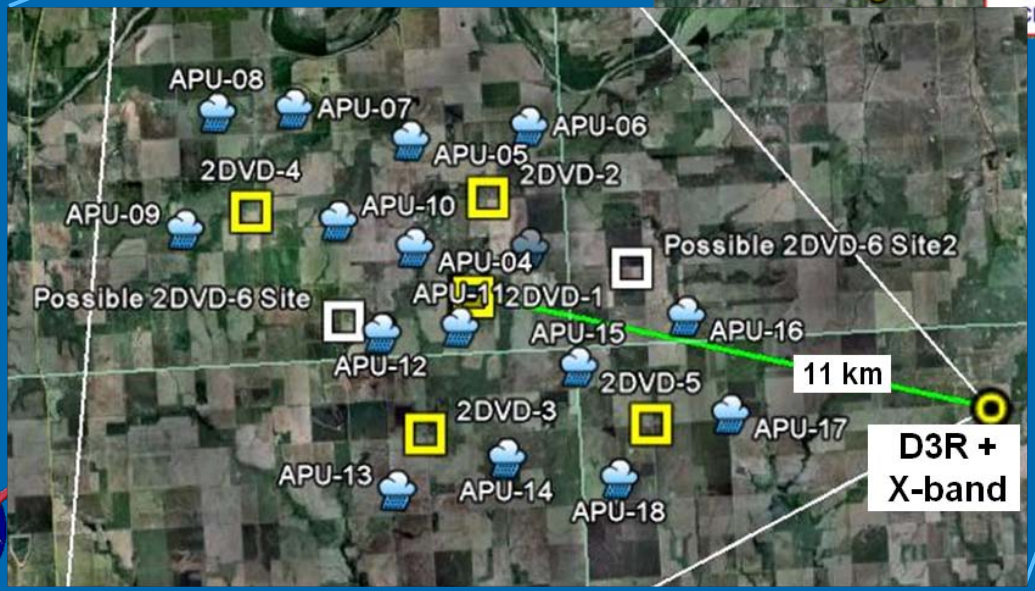
1) Advance the understanding of the different components of convective parameterization
   - Focus: Convective initiation and up/downdraft coupling to precipitation and cloud microphysics.

2) Improve the fidelity of satellite estimates of precipitation over land.
   - Focus: Observation and quantification of dominant column microphysical processes impacting satellite-based passive/active microwave retrievals

MC3E Sampling: Ground

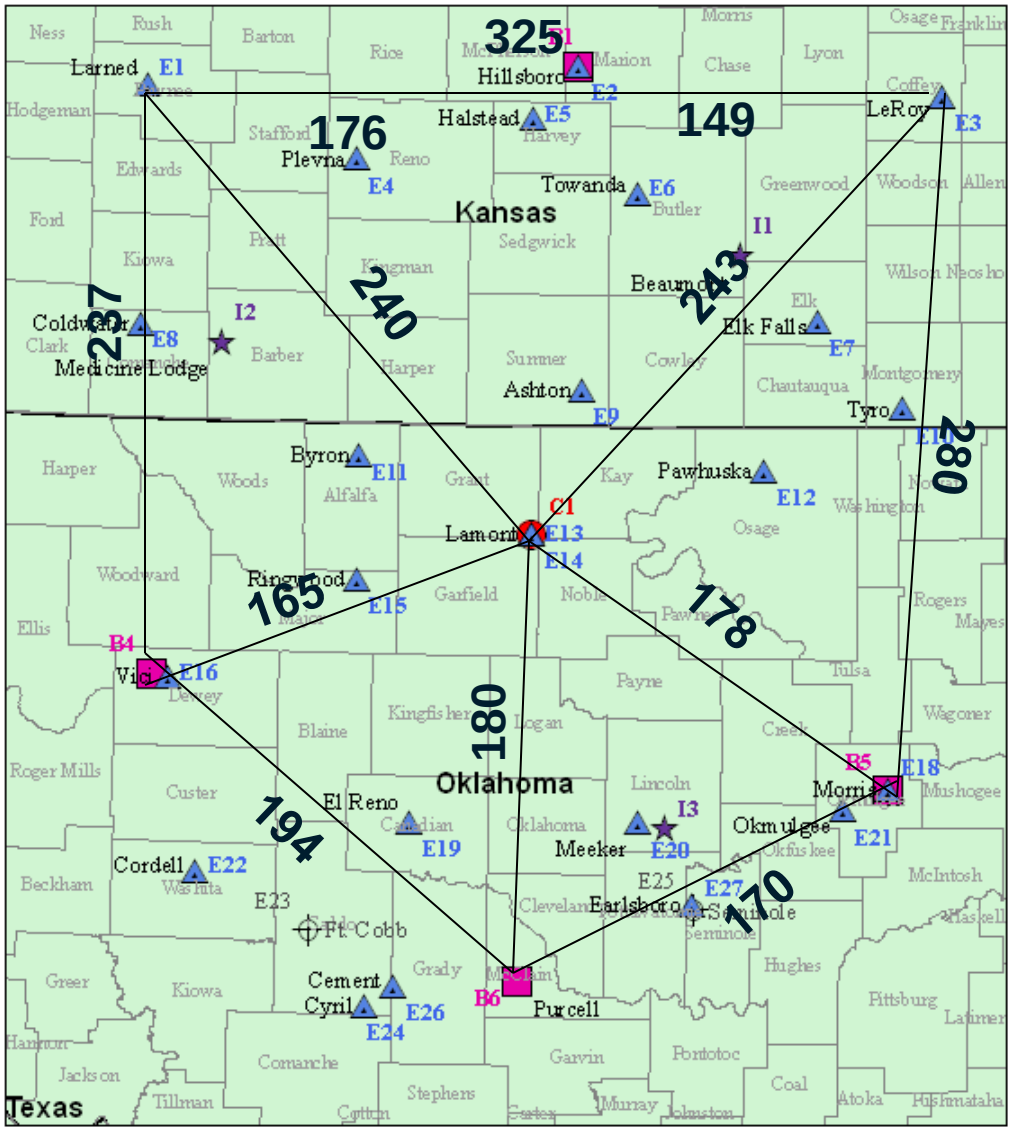
- Multi-Freq./ Doppler / polarimetric/ profiling radars
  - Sub-pixel DSD/rain variability
  - "Bootstrapped" 3-D domain DSD
  - 3-D (solid/liquid/mixed) HID
  - Cloud water……(maybe)
  - Kinematics
- Network embedded in sounding array
  - CRM Forcing
  - Budgets





NASA Disdrometer network

- 5 2DVD 3rd Generation, compact
- 16 Parsivel (Autonomous)
- 1-3 Joss (915 Profiler collocated)
- 20-40 Rain gauges collocated



MC3E Sounding Network

Proposed Sounding Sites

- E1 Larned, KS [38.202, -99.316]
- E3 LeRoy, KS [38.201, -95.597]
- B4 Vici, OK [36.071, -99.204]
- B5 Morris, OK [35.687, -95.856]
- B6 Purcell, OK [34.985, -97.522]
- C1 Lamont, OK [36.605, -97.485]

NOAA Wind Profilers are at:

C1, B4, B5, B6 and B1 Hillsboro, KS [38.305, -97.301], Haviland, KS [37.65, -99.09], Neodisha, KS [37.38, 95.63]

Sounding launches – 4 or 8 per day.

GPM Airborne Assets in MC3E

GPM Core Satellite "Simulator"

NASA ER-2:
GMI/DPR Proxy

Base: Albuquerque (Kirtland) AFB , NM

Instrument	Characteristics
AMPR (Radiometer, H +V)	10.7, 19.35, 37.1, 85.5 GHz
Resolution @ 20 km range	0.6 km (85.5 GHz), 1.5 km (37.1 GHz), 2.8 km (10.7-19.35 GHz)
CoSMIR(Radiometer, H+V)	37, 89, 165.5, 183.3+/-1, 183.3+/-3, 183.3+/-8 GHz
Resolution @ 20 km range	1.4 km footprint at nadir
HIWRAP Ka-Ku band Radar	13.91/13.35 GHz, 35.56/33.72 GHz
Transmit peak power	30 W (Ku), 10 W (Ka)
3 dB beamwidth	2.9° Ku, 1.2° Ka
MDS (dBZ_e, 60 m res., 3.3 μs chirp pulse, 10 km range)	0.0, -5.0 dBZ_e

In Situ MIcrophysics

UND Citation Microphysics

Base: Ponca City, OK

Instrument	Measurement
FSSP/King	Cloud liquid water
PMS 2D-C/P	Cloud and precipitation particle spectra
HVPS	Large hydrometeor spectra
2D-S	Cloud particle spectra
CDP and/or SID	Cloud particle spectra
Nevzorov and CVI	Total water content
Rosemount icing probe	Supercooled liquid water
CN/CNN/IN	Still TBD

What does this have to do with the CAPI working group?

Although MC3E was conceived as a convective parameterization field program, there will be plenty of opportunities to do related science.

Fridlind et al. (2004), for example, showed the importance of mid-tropospheric aerosol concentration on anvil ice microphysics.

But……

The current MC3E science plan does not include observations of aerosol profiles.

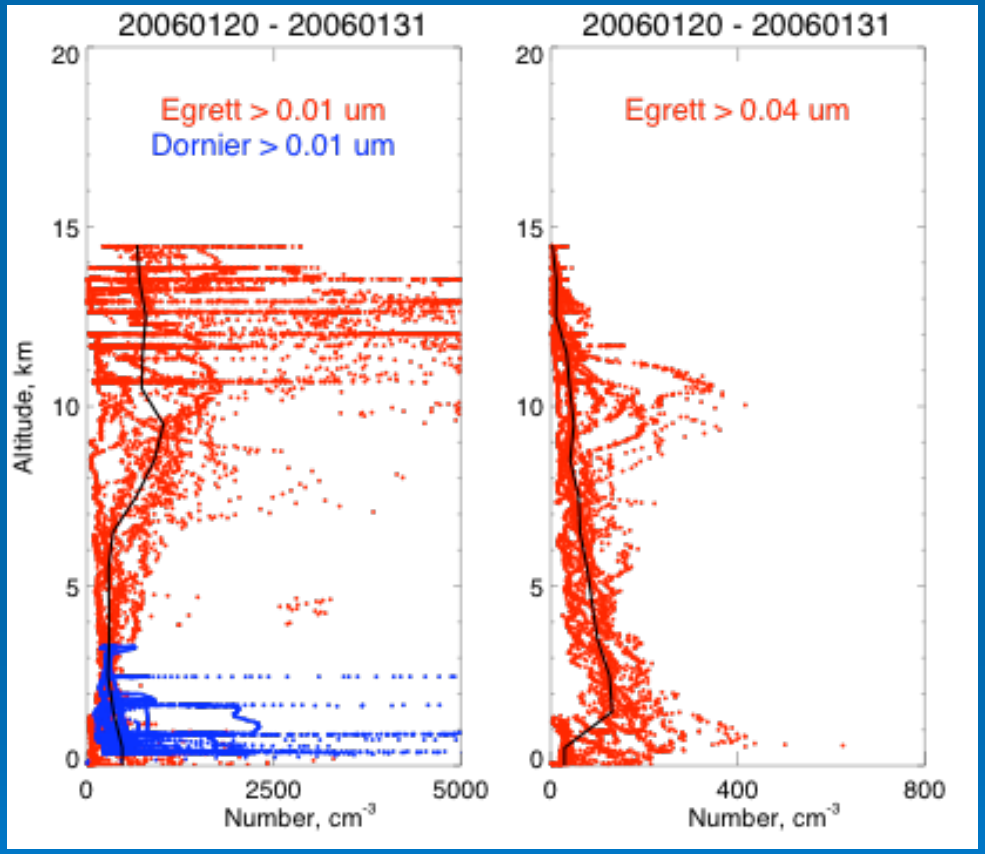
Possible small proposal for deployment of CCN instrumentation (CPC, UHSAS for < $25K)

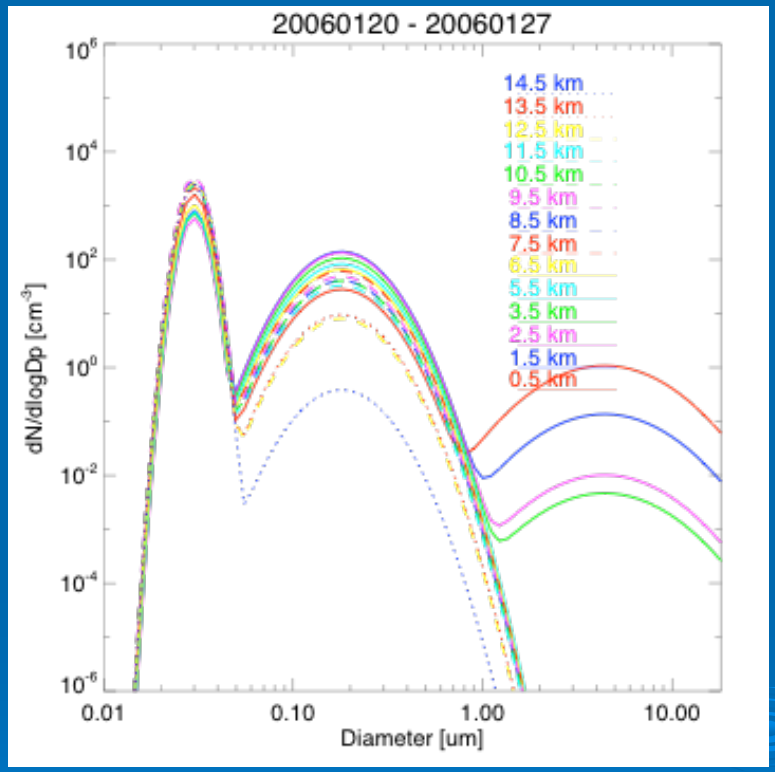
Modern models need aerosol profiles

- Today's models that robustly treat aerosol indirect effects (e.g., two-moment, higher-moment, and size-resolved schemes)
  require aerosol input profiles
- Because aerosol numbers vary by orders of magnitude (vertically, horizontally, and temporally),
  climatic data or "guesses" are not sufficient
- When airborne aerosol data are available, they get wide use!
- When airborne aerosol data are missing, modelers are missing
  a crucial puzzle piece for any CRM-based work

Slide courtesy of A. Fridlind

TWP-ICE data → model aerosol profile

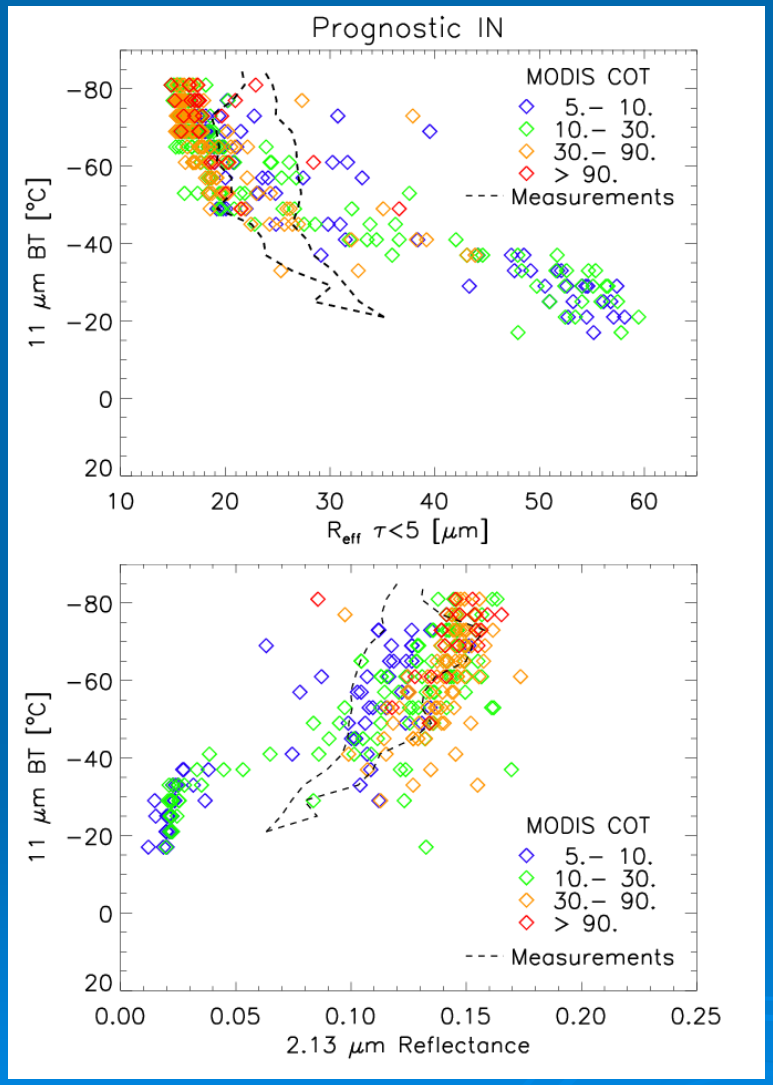


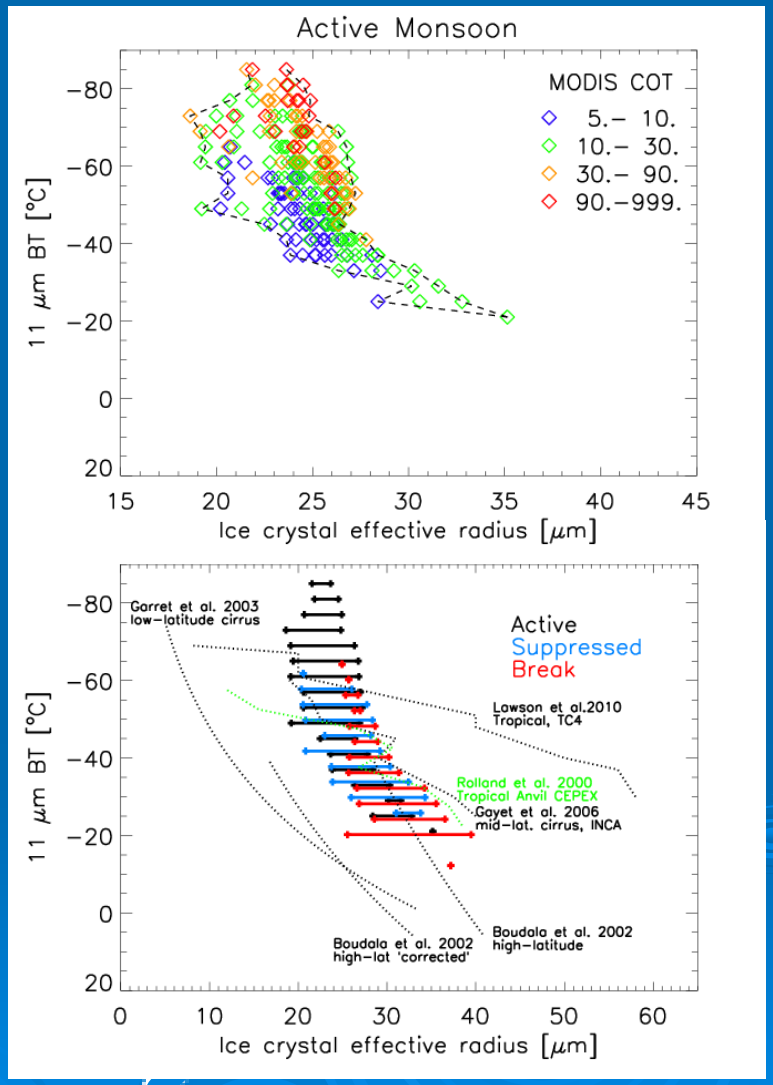


Data sources: Martin Gallagher, Paul Williams, Andrew Heymsfield, Aaron Bansemer

Slide courtesy of A. Fridlind

Bin model ice eff. radius ←→ MODIS

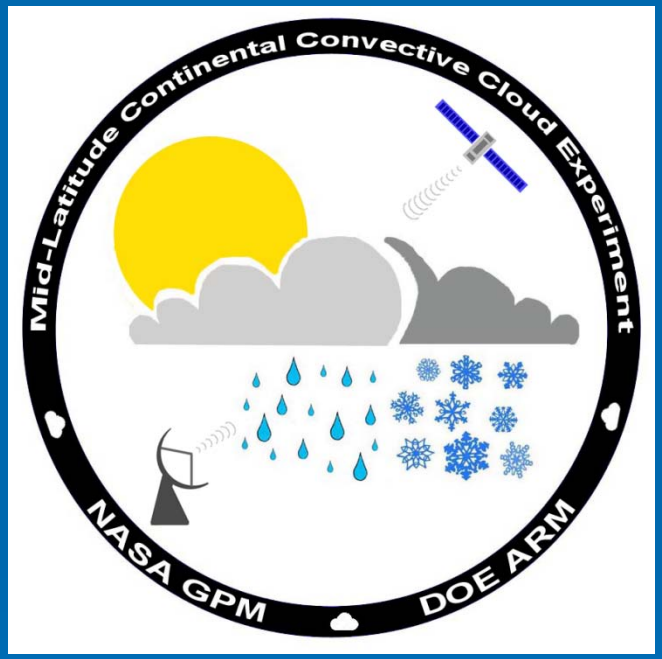




Source: Bastiaan van Diedenhoven

Slide courtesy of A. Fridlind

Thank you! Questions?



Interested in more details?

MC3E breakout tomorrow evening (7:00-8:30)