DOE - ARM / NASA - GPM

Midlatitude Continental Convective Cloud Experiment (MC³E)

- SGP
- May - June 2011

Michael Jensen (BNL), Pavlos Kollias (McGill)
Anthony Del Genio (NASA GISS)  Scott Giangrande (McGill)
Partnering with NASA GPM, CASA, NSF DC-3, Oklahoma University, NSSL, OK Climate Survey, NASA CloudSat
ARM Key Science question #4: How do radiative processes interact with dynamical and hydrological processes to produce cloud feedbacks that regulate climate change?

Goal: Improve climate models!!

**Elements Convective Parameterization**
1) Pre-convective environment
2) **Convective Initiation**
3) **Updraft/Downdraft Dynamics**
4) Condensate Transport/Detainment
5) **Precipitation/Cloud microphysics**
6) Influence on environment
7) Influence on Radiation
8) Large-scale forcing

Big Question: Given PBL (T,q) and vertical profiles, can the precipitation at the ground be predicted? (A. D. Del Genio)
CASA IP1 Radar array and ARM RWP locations
ARM-funded IOP Measurement Priorities

• Model Forcing Dataset
  Sounding network
  Appropriate for determining continuous forcing dataset

• 4D Atmospheric state description
  Soundings (Array and soundings of opportunity)
  Radar Refractivity
  Surface Observations

• 4D Cloud and Precipitation characteristics
  CASA, CIRPAS 9.4 Ghz Phased-Array, McGill scanning 94-GHz, ARM SBIR scanning 35-GHz

• Updraft/Downdraft dynamics
  CASA, 915 MHz wind profilers, cloud radars
**NASA-Provided Infrastructure**

*Calibrated* measurement continuity across full spectrum of precip. rates/types

**Ka-Ku Scanning Transportable Dual-Polarimetric Radar (dual-aperture)**
- Match DPR frequencies, direct link to PIA and dual-wavelength vs. dual-pol methods
- Extension to clouds, light precipitation, and improved sampling of ice, snow, mixed phase
- Mobility enables placement in variety of network configurations/regimes with relative ease

**NASA PMM N-POL S-band Scanning Dual-Polarimetric Radar**
- Transmitter, receiver, and antenna upgrades completed by fall 2010.
- Transportable platform for study of heavy/moderate precipitation regimes
- Dual-pol retrieval of 3-D DSD information and qualitative ice microphysics information

**2D Video Disdrometer (or other TBD) Dense Array, supplemented by rain gauges**
- Validation/extension of GV satellite simulator and ground radar DSD retrievals/precipitation rates (liquid/frozen)
- Spatial/temporal covariance of particle size distributions and precipitation rates

**Wind Profiler**
- Vertical profiles of Z, DSD collocated with disdrometers under coverage umbrella of radar

**Aircraft**
- High altitude (ER-2 w/ GMI and DPR simulators) Aircraft already reserved
- In-situ AC (e.g., UND Citation) for microphysics Cost estimate obtained

**Other Known (CloudSat):** W-band radar w/RHI-scanning/V-pointing
An Opportunity for the ARM program

- Unprecedented 4-D observations of convective clouds and environment

- State-of-the art 3D scanning observations

- Foster collaborations with NASA-GPM, CASA, OU, NSSL

- Leverage existing climatological observations