Cloud Life Cycle Working Group Overview

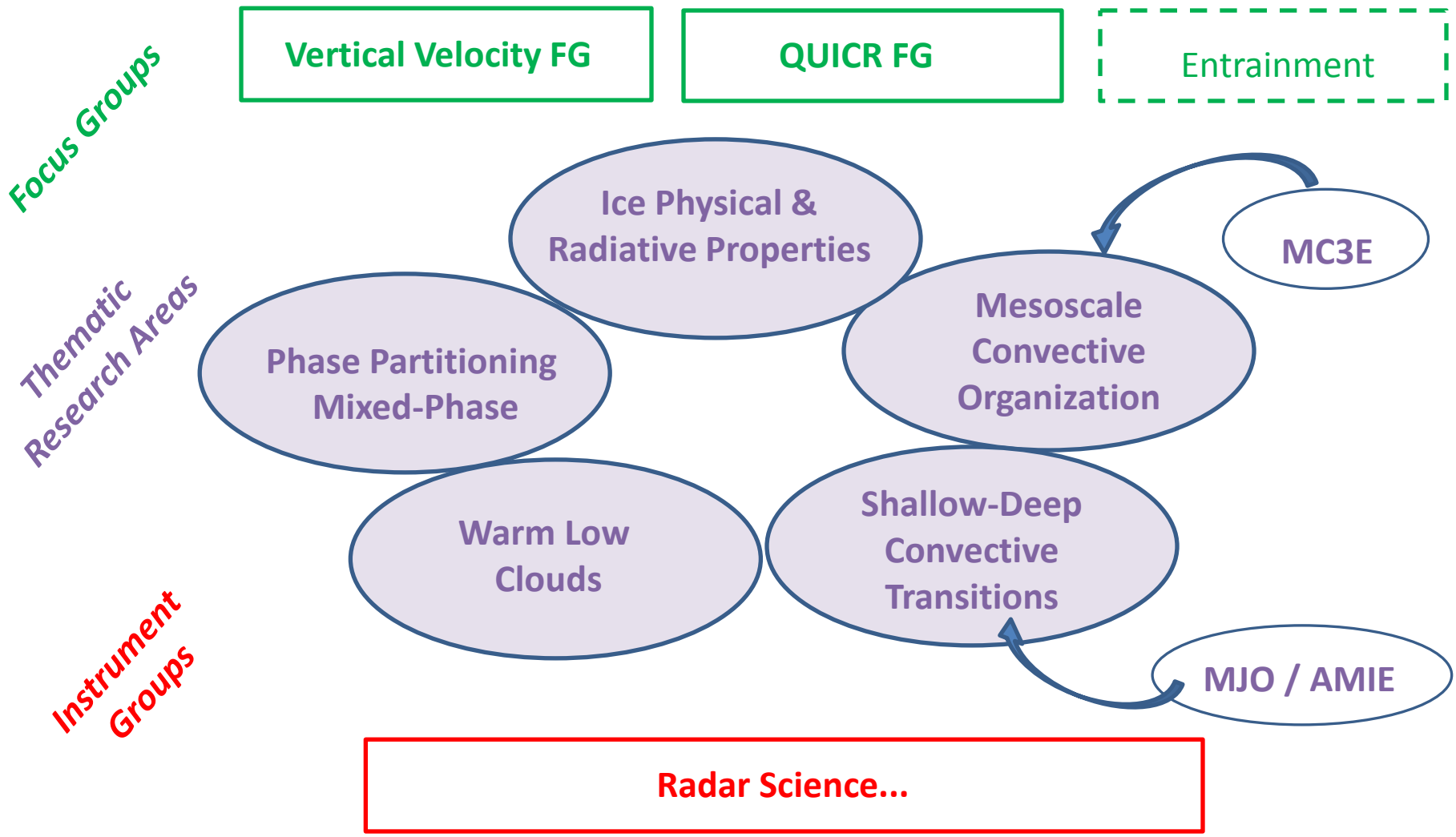
2013 Fall Meeting

Rockville, MD

Tony Del Genio

Matthew Shupe

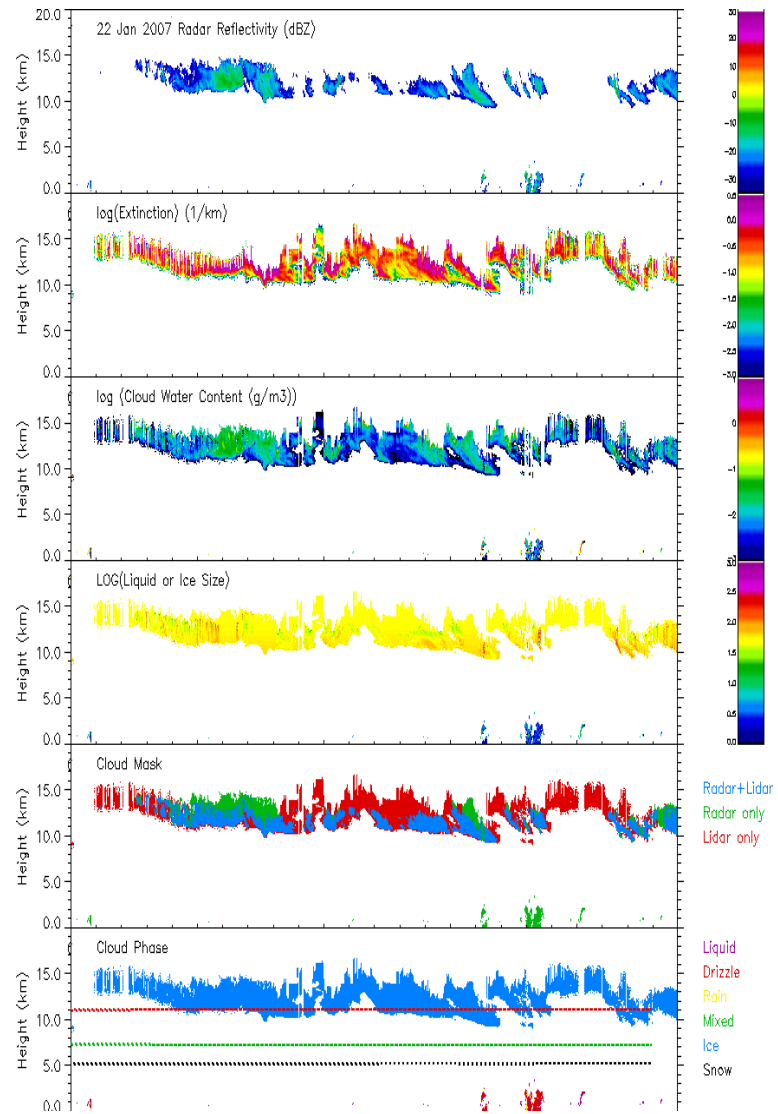
Status of CLWG > Meeting Agenda



Quantification of Uncertainty in Cloud Retrievals (QUICR)

(Shaocheng Xie, Jay Mace)

- DOE is a leader in cloud retrievals & has resources to address uncertainty.
- Retrieval frameworks, covariances, forward models, a priori assumptions
- Joint DOE-EU workshop on cloud retrievals
  - Common guidelines
  - Coordinated data sets
  - Sharing data, codes, methodologies
- BAMS article outlining retrieval issues
- Many activities:
  - BBHRP,
  - in situ,
  - Simulator uncertainty
- AGU session this year.



Vertical Velocity Focus Group

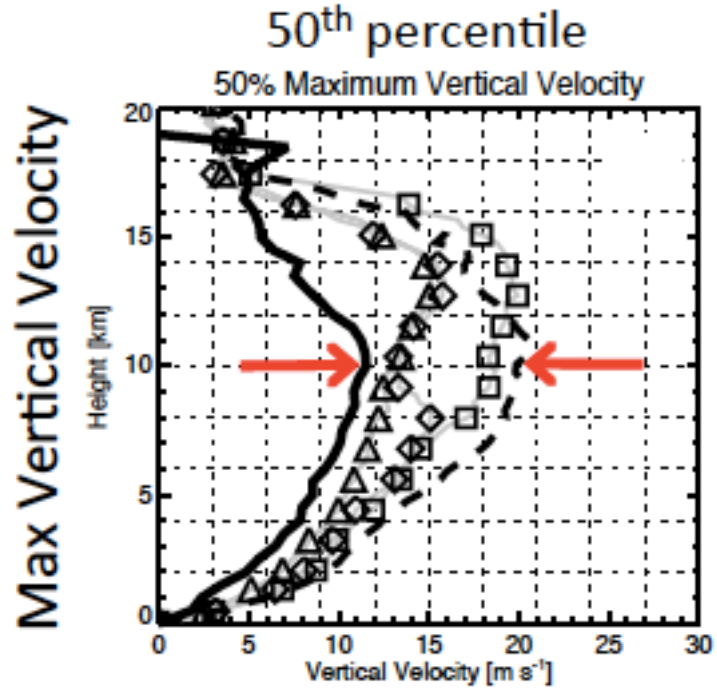
(Virendra Ghate, Jennifer Comstock)

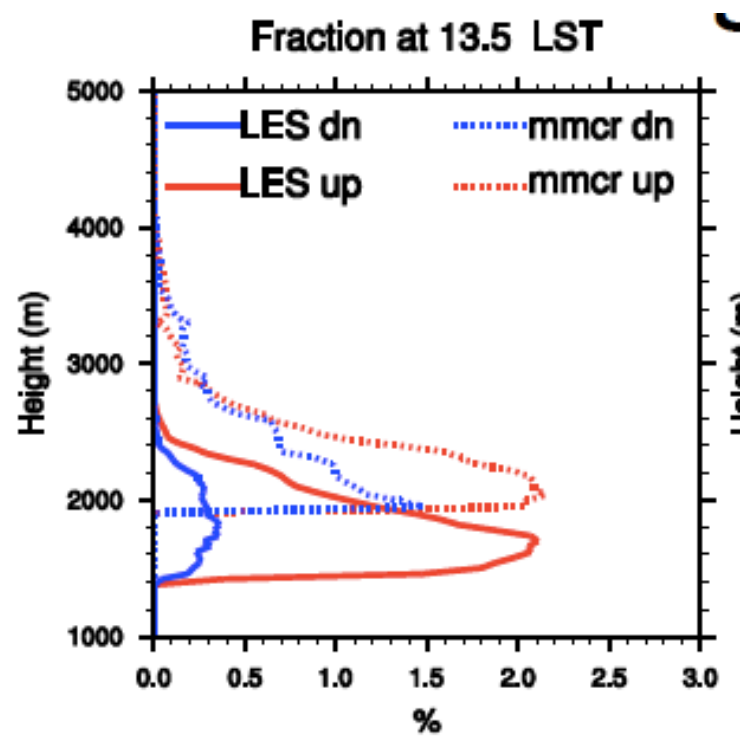
Products:

- Clear air and warm clouds (Newsom, Luke)
- Deep convective (North) and stratiform (Jensen) precipitation
- Mixed phase clouds (Shupe)
- Cirrus clouds (Kalesse)

Thrusts/Issues:

- Uncertainty of retrieved VV estimates
- Seamless vertical velocity best estimate
- New techniques and datasets for deep convective drafts
- Model-retrieval discrepancies
  - Large updraft speeds & high altitude of peak in tropical deep conv. (Varble et al.)
  - Updraft vs. downdraft fraction and mass fluxes in shallow convection (Klein, Zhang)





Entrainment

(Mike Jensen)

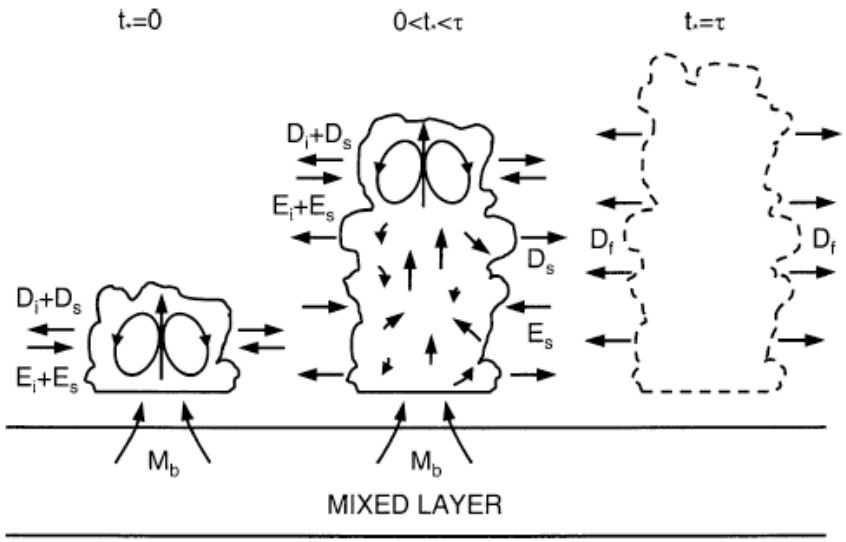
Two separate problems

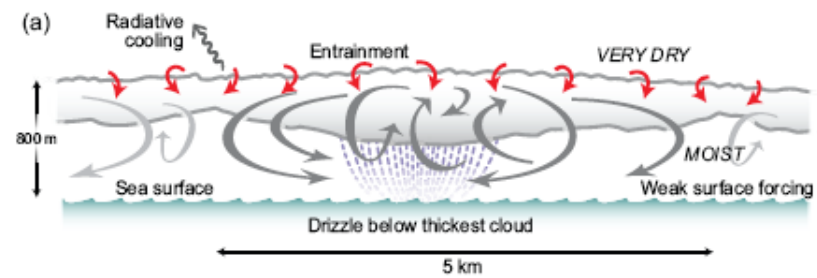
- **Convective updrafts**
- **Stratocumulus**

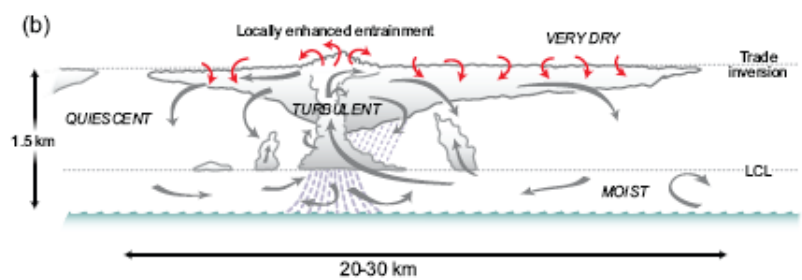
1)Utilize existing long-term ARM data to retrieve relevant cloud and environmental parameters

2) Forward modeling of ARM remote sensing observations using LES results

- PI driven entrainment retrievals (too soon for infrastructure effort)
- Possible dual foci (stratocumulus, cumulus)
- Azores Stratocumulus – Krueger, Turner
- SGP Cumulus – Romps, Jensen
- Future consideration of entrainment focus IOP







Warm Low Clouds

(Mark Miller, Minghua Zhang, and others)

Organizing around 3 areas:

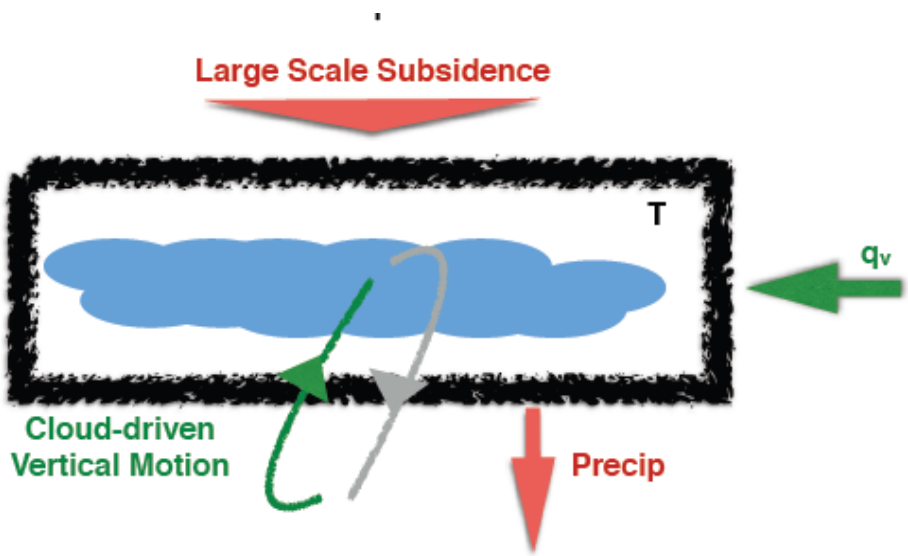
1) Tropical shallow convection
   AMIE Gan, Manus
2) Marine/coastal Sc
   AZORES, TCAP
3) Continental low clouds
   RACORO, SGP, FASTER

Approaches:
Use SCM + long term macro products + synoptic classifications to identify model issues
=> Evaluate these with detailed LES and observational data sets.

Emphasis on characterizing cloud water.
Look at interacting processes ("joint-PDFs"): cloud macrostructure, vertical velocity, entrainment, microphysics, radiation

Phase Partitioning Mixed-Phase

(Gijs de Boer,
Jerry Harrington)

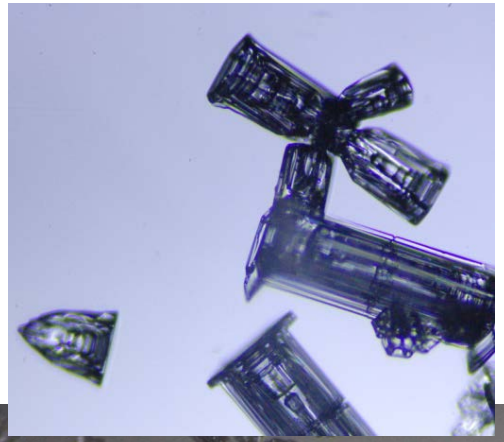


- **Group Direction:**
  Simple modeling frameworks to examine evolution of water budget in Arctic mixed-phase clouds and evaluate scaling relationships relating cloud phase and cloud properties.
- Focus on *mass flux* from the cloud.
- Use models at various scales (operational, LES, CRM)
- Well positioned to use new measurements in Alaska

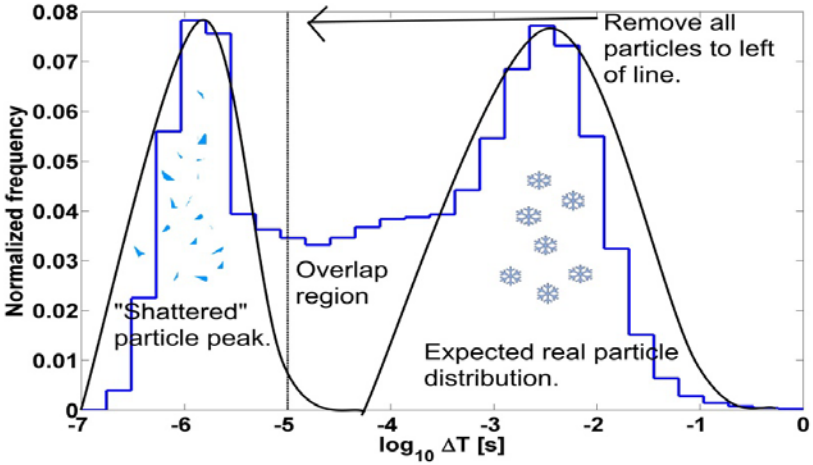
- Acknowledge importance of phase in deep convection…….

Ice Physical and Radiative Properties

(Greg McFarquhar, David Mitchell)

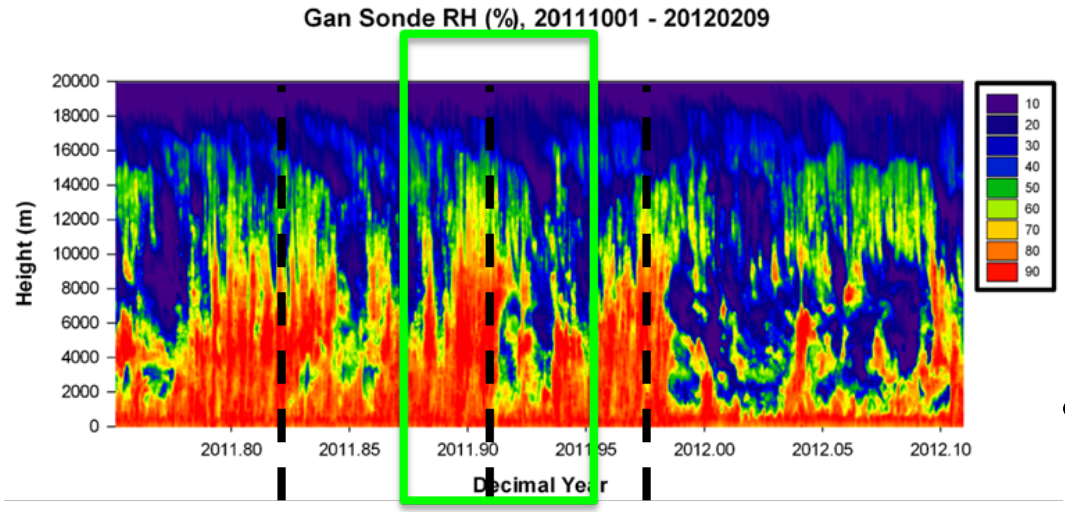


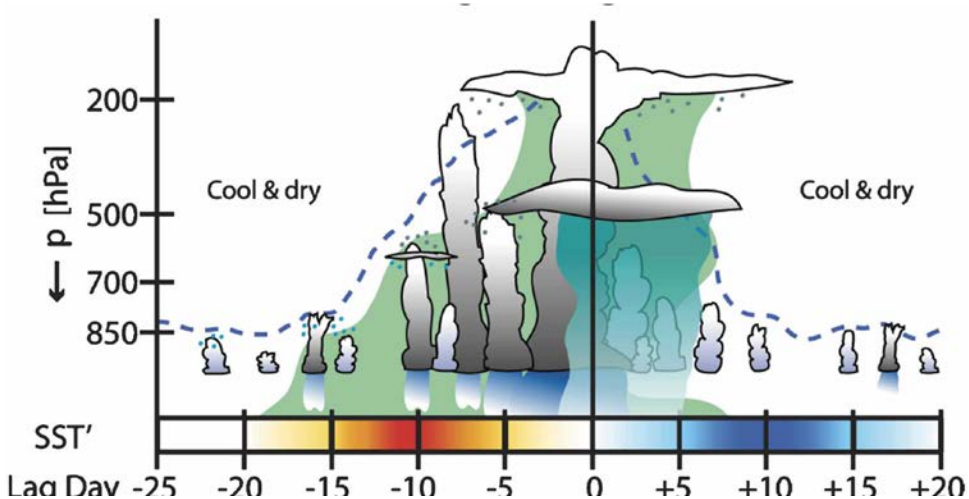
- Ice size distribution characterization:
  - Deal with measurement issues
  - Apply corrections
  - Products of interest: size dist'n, mass-dimensional relationships, etc.
- Develop a framework to understand how uncertainty in ice properties impacts abilities to determine radiative forcing.
- Improve large-scale model microphysical schemes >> making self-consistent assumptions for different processes (growth, fall speed, mass, radiation, etc.)



MJO + Shallow-Deep Convective Transitions

(Chuck Long, Chidong Zhang, Steve Krueger)





- Mid-level moistening:
  - convective detrainment vs. large-scale advection
  - time scale of transition, individual events vs. composite
  - hydrometeor distributions, how to compare with models
- Model sensitivity to μ-physics parameterization
- Model forcing data sets
  - Xie ECMWF+Precip constraint vs. Ciesielski-Johnson sondes-based
  - model result differences between the two?

Mesoscale Convective Organization (MCO)

(Courtney Schumacher, Adam Varble)

- Link vertical velocity and μ-physics in initiation (convective), transition (convective-stratiform), and maintenance (stratiform, non-precipitating anvil) stages of mid-latitude and tropical MCS

- Cold pools (Angela Rowe, Feng Zhe)

  - How do you make them?

  - How do they help organize and maintain MCSs?

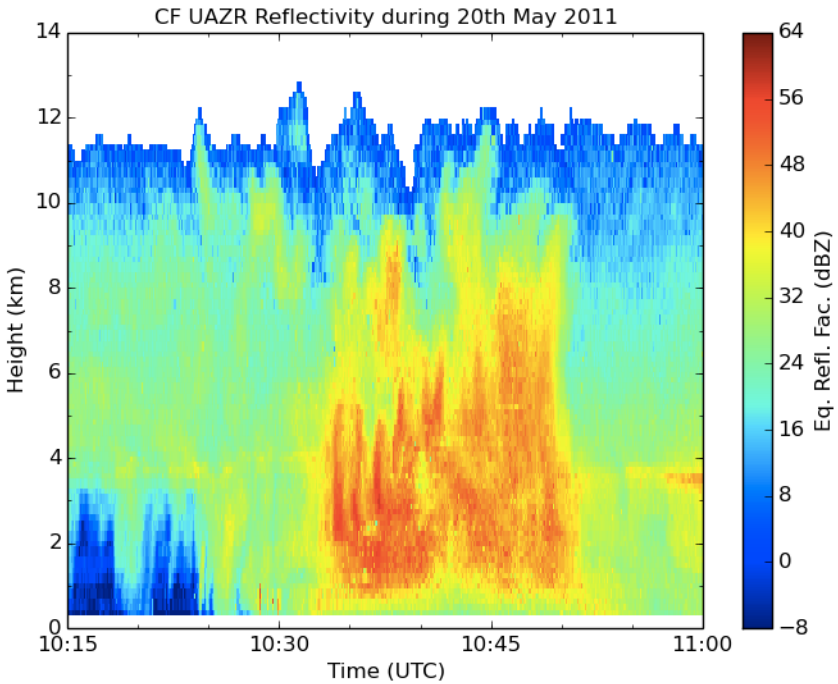
  - How can we link them to GCM parameterizations of convection and organization?

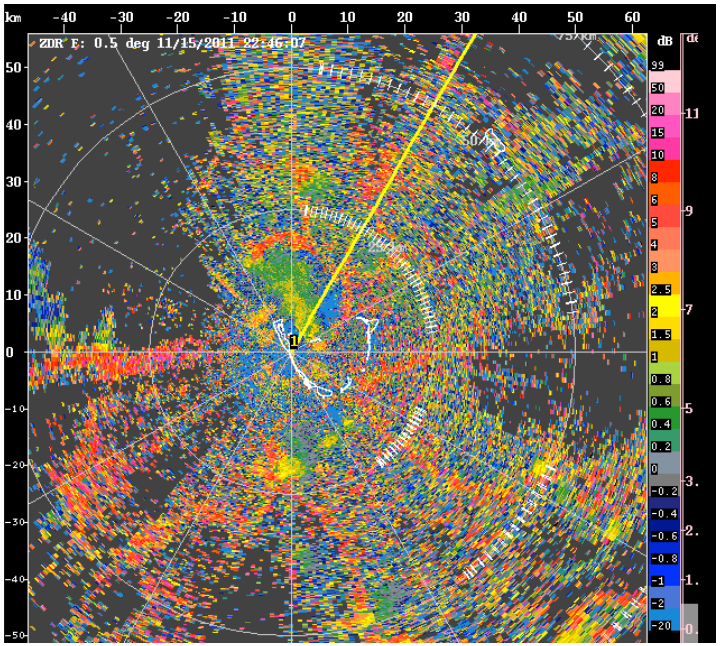
- MCO database:

  MC3E: 25 Apr., 20 May, 23 May 2011

  AMIE: Nov. 2011 active phase MJO

  TWP-ICE: 19 Jan., 23 Jan. 2006



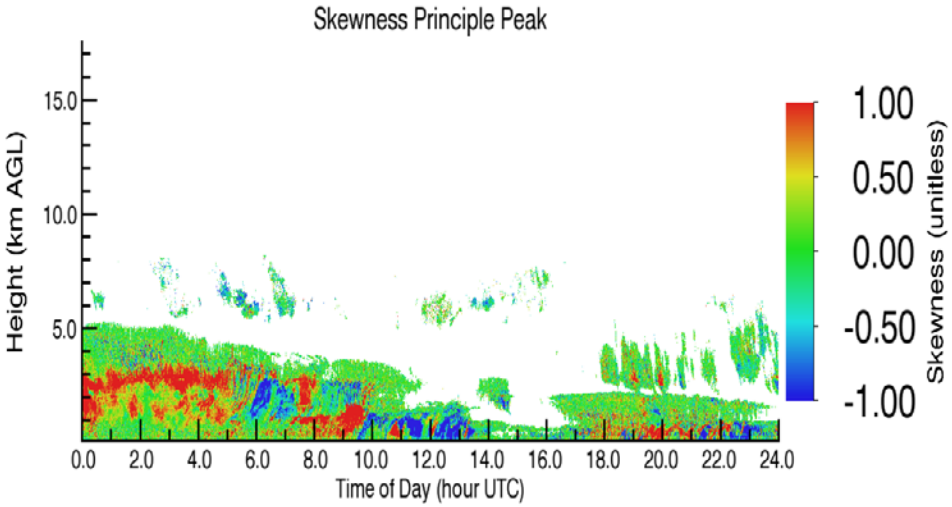


Radar Science

*(*Pavlos Kollias, Eugene Clothiaux, Courtney Schumacher, Silke Troemel, Matthew Shupe*)*

Explosion of New Capabilities

- Scanning
- Multiple frequencies
- Polarimetry
- Clean Doppler spectra



Opening the Door for New Science

- New look at processes, process rates?
- Habit identification
- Improved microphysics & dynamics