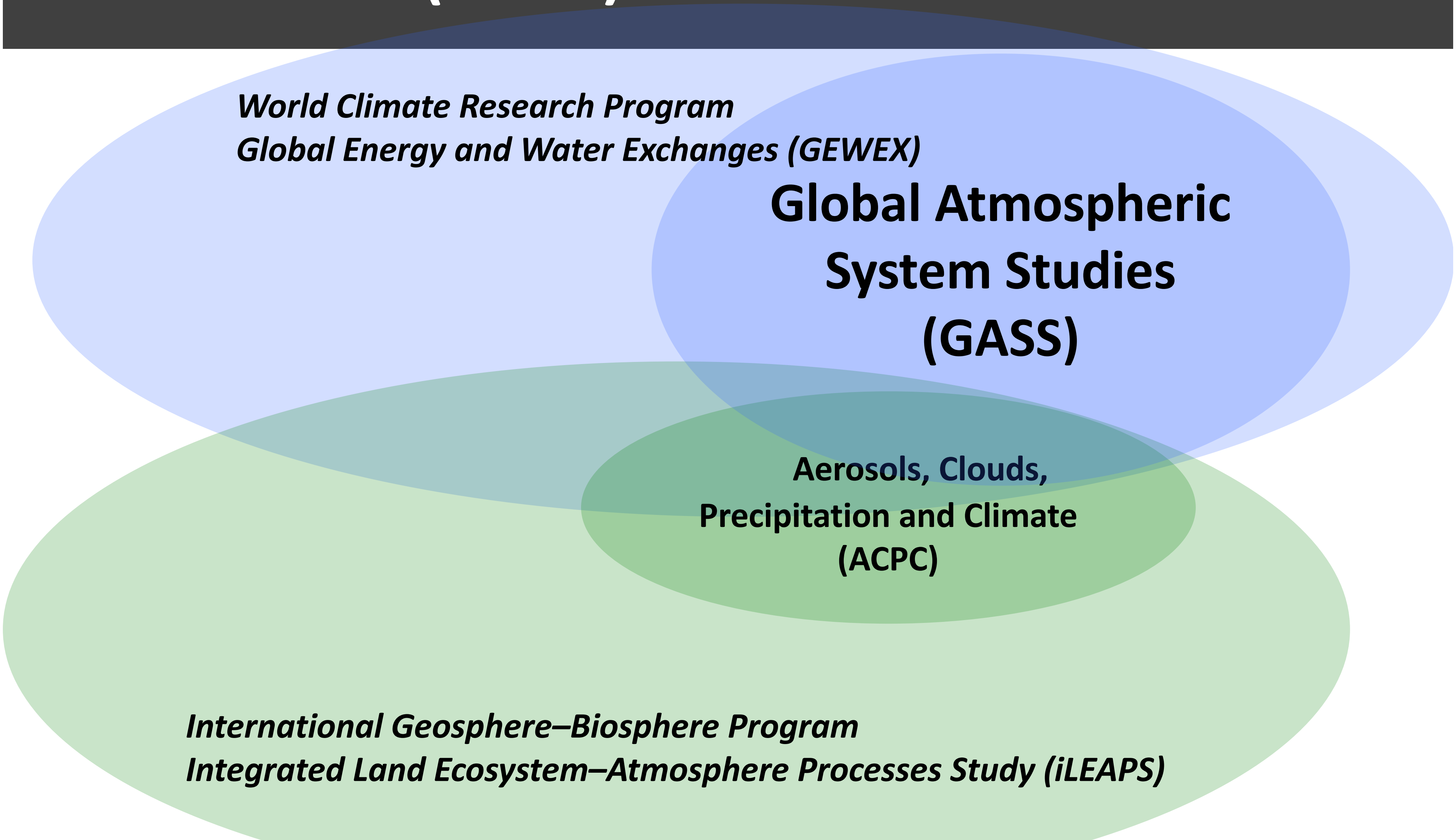
The Aerosols, Clouds, Precipitation and Climate (ACPC) Initiative



GEWEX and iLEAPS

- GEWEX panels
  - Global Land/Atmosphere System Study (GLASS)
  - Global Atmospheric System Studies (GASS)
    - DICE (SCM-LSM coupling)
    - CIRC II (SCM radiative transfer)
    - Arctic Air Formation (SCM-LSM)
    - …
  - GEWEX Hydroclimatology Panel (GHP)
  - GEWEX Data and Assessments Panel (GDAP)
- iLEAPS initiatives
  - Interdisciplinary Biomass Burning Initiative (IBBI)
  - Interactions among Managed Ecosystems, Climate, and Societies (IMECS)
  - Extreme Events and Environments (EEE)
  - Aerosols, Clouds, Precipitation and Climate (ACPC)
  - Bridging the gap between iLEAPS and GEWEX land-surface modelling
  - ...

ACPC

- Science
  - How do aerosol-precipitation interactions manifest themselves at the full range of temporal and spatial scales in the climate system?
- Co-chairs
  - Danny Rosenfeld
  - Johannes Quaas

"a route to progress is proposed here in the form of a series of box flux closure experiments in the various climate regimes"

Reviews of Geophysics
AN AGU JOURNAL

Review Article

Global observations of aerosol-cloud-precipitation-climate interactions

Daniel Rosenfeld, Meinrat O. Andreae, Ari Asmi, Mian Chin, Gerrit de Leeuw, David P. Donovan, Ralph Kahn, Stefan Kinne, Niku Kivekäs, Markku Kulmala, William Lau, K. Sebastian Schmidt, Tanja Suni, Thomas Wagner, Martin Wild, Johannes Quaas

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April 2015 ACPC Workshop (NASA GISS)

- consider whether modern satellite measurements and other instrument advances enable useful mass, energy and water budget closure
- focus on regimes susceptible to aerosol influences that experience substantial aerosol perturbations
- awareness that experimental uncertainties are substantial (e.g. in OLR and RSW derived from geostationary satellites)
- carry out observation system simulation experiment (OSSE) approach in two target conditions
  - shallow convection in the VOCALS region as a proxy
  - deep convection in the Houston region specifically

Possible budget results

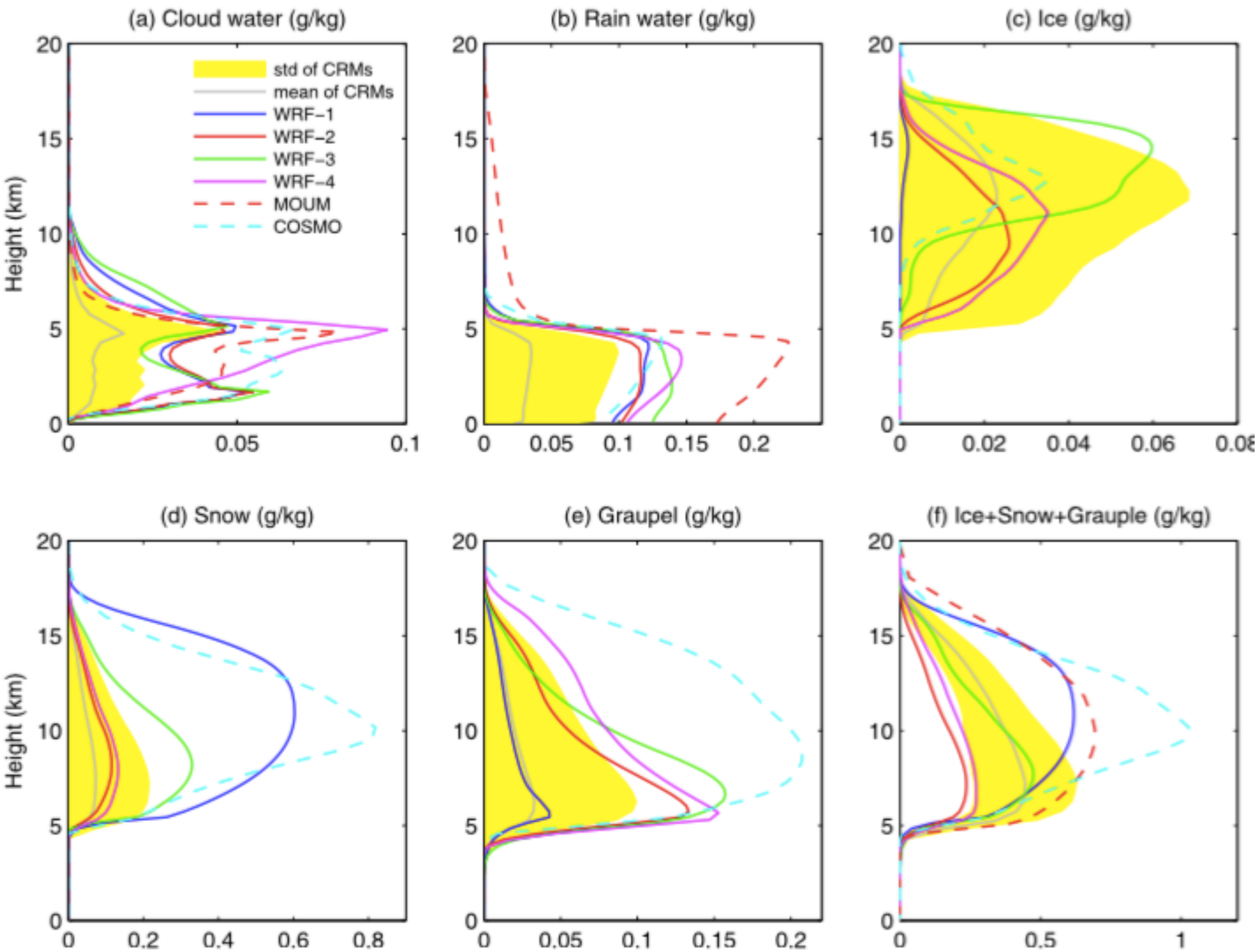
Table 3. Simulated Domain-Mean Quantities Averaged Over the Active Monsoon Period (19.5–25.5) That Are Within the Range of Observational Data Plus and Minus Uncertainties[a]

Simulation	Precipitation[b]	Area[c]	Convective[d]	Stratiform[d]	IWP[e]	OLR[f]	RSR[g]
DHARMA-1	yes	+	+	+	+	+	yes
DHARMA-1s	yes	+	+	–	+	+	yes
DHARMA-2M	yes	+	+	+	+	yes	+
EULAG-2	yes	+			+	+	yes
EULAG-2s	yes	+			+	+	yes
ISUCRM-2	yes				+	yes	+
MESONH-1	yes	+	+	–	+	+	yes
MESONH-2	yes	+	yes	yes	+	+	–
SAM-2M	yes		+	+	+	–	yes
SAM-2Ms	yes		+	+	+	yes	–
UKMO-2A	yes		yes	+	+	yes	yes
UKMO-2B	yes		+	+	+	+	–
UKMO-2M	yes		+	+	+	–	yes

[a]Within the range: yes; higher than that range: +; lower than that range: –; not diagnosed or reported: blank.
[b]Mean surface precipitation rate versus C-POL with uncertainty of 25% (see section 4.1, Figure 5).
[c]Total occurrence frequency of precipitation rates exceeding 0.2 mm h^{-1} at 2.5-km elevation and 2.5-km resolution versus C-POL range of 0.21–0.28 (see section 4.1, Figure 6a).
[d]Fractional area of convective and stratiform rain in 3D models versus C-POL (using the algorithm described in Appendix B) with uncertainties of 20% and 5%, respectively (see section 4.1, Figure 9).
[e]Ice water path versus 3D-IWC with uncertainty of 20% (see section 4.8, Figure 11).
[f]TOA outgoing longwave radiation (OLR) versus VISST (same as large-scale forcing data set) with uncertainty of +9/–4% (see section 4.2, Figure 22).
[g]TOA reflected shortwave radiation (RSR) versus the large-scale forcing data set (based on VISST) with uncertainty of +7/–15% (see section 4.2, Figure 22).

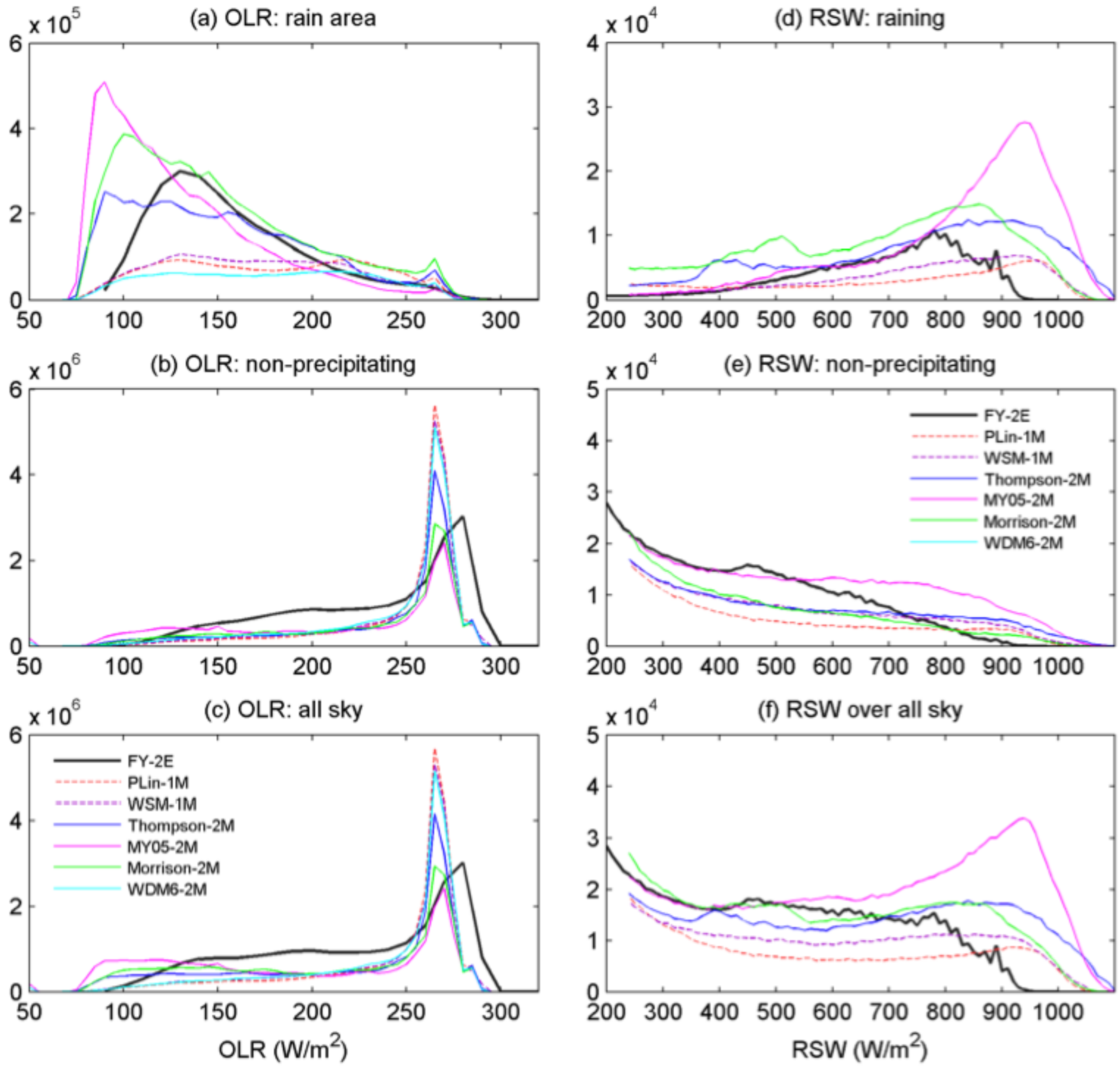
Fridlind et. al (JGR 2012)

Possible microphysics results



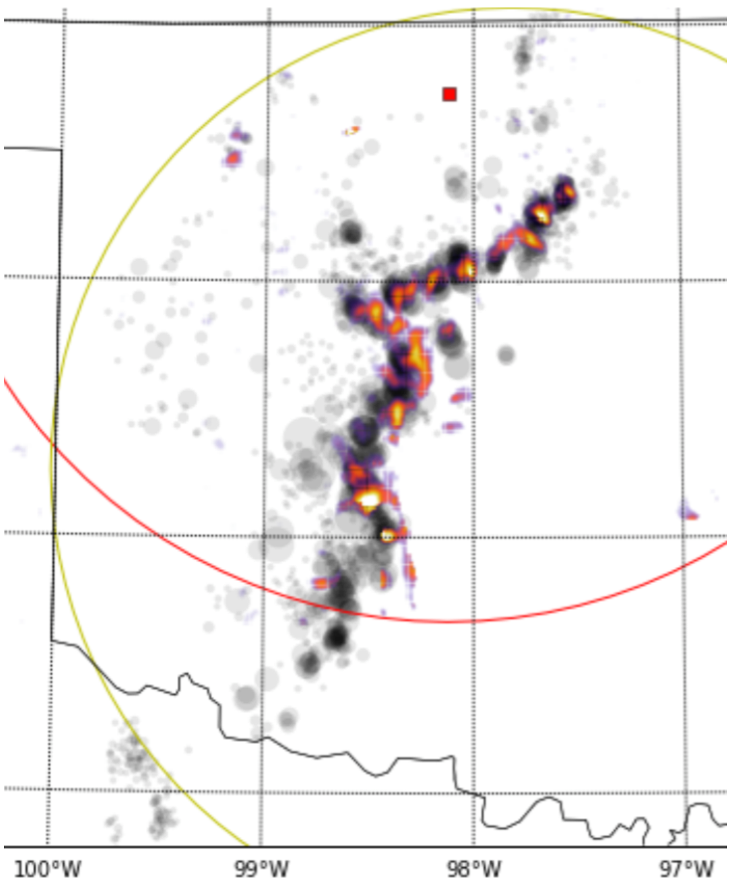
TWP-ICE
Zhu et al. (JGR 2012)

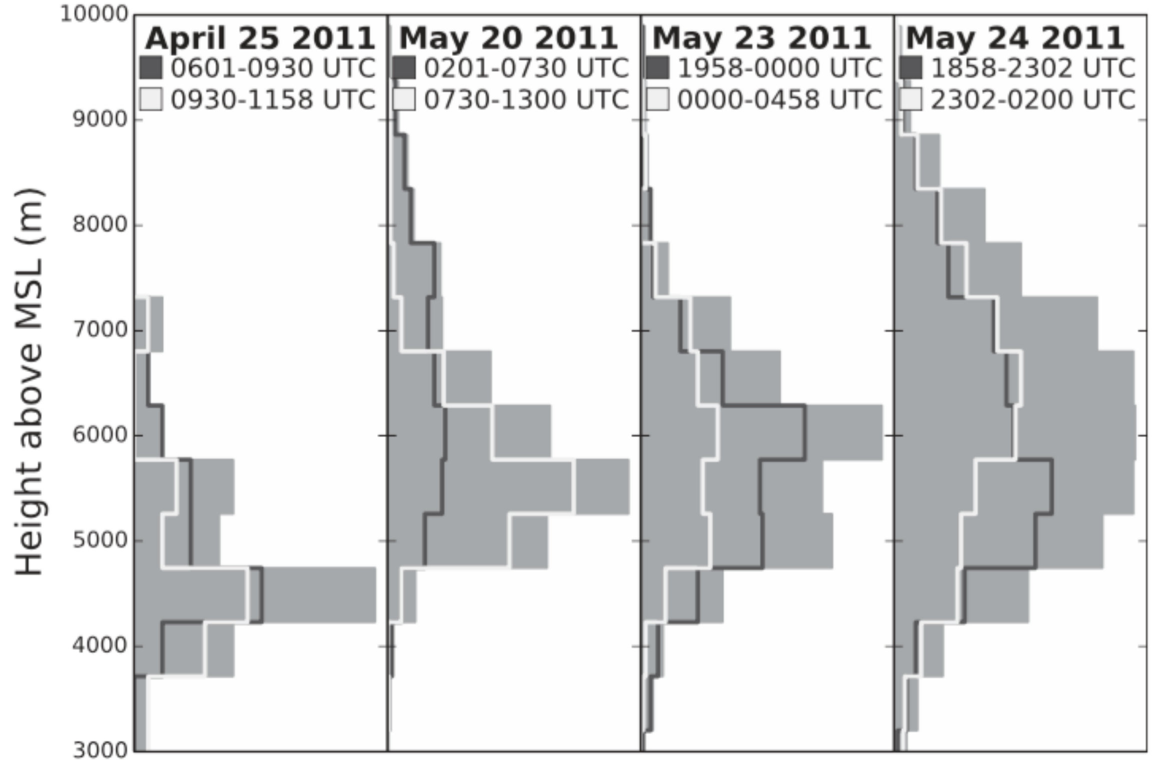
Possible pattern analyses (subdomains or not)



DYNAMO
Wang et al. (JGR 2015)

Possible polarimetric radar cell tracking





MC3E K_{dp} above the melting level
Van Lier-Walqui et al. (MWR 2016)

Today's breakout agenda

- 4:20 pm — Alexander Ryzhkov/Danny Rosenfeld: Polarimetric cell tracking under different CCN
- 4:30 pm — Jeff Snyder: Application of upgraded HUCM forward operator to simulated updrafts with varying CCN
- 4:40 pm — Marcus van Lier Walqui: Houston upraft tracking using NEXRAD Kdp and NU-WRF
- 4:50 pm — Sue van den Heever: Houston case study specifications using RAMS and WRF
- 5:00 pm — Jiwen Fan: Houston case study WRF-Chem-SBM simulations
- 5:10 pm — Graham Feingold: Houston GoMACCS results and lessons learned
- 5:20 pm — Pavlos Kollias: Radar configurations to observe isolated updraft microphysics evolution
- 5:30 pm — Open discussion

Houston field campaign discussion

- Concept level
  - good idea, good location?
  - problems with approach?
    - observations
    - simulations
- Implementation level
  - funding sources?
  - strategy suggestions?
  - action items?
    - this week
    - going forward

How can we make automated SAPR cell tracking algorithms happen? —Adam Varble

- They are clearly of long-term benefit to ARM and ASR science focused on processes that need to be parameterized in models
- Is a proof-of-concept ARM IOP needed at SGP?
  - Who will be involved? Who will lead?
  - When can this happen? Before CACTI (September 2018) or an ACPC-Houston?
- Potential barriers need to be overcome
  - There is a lot of support for this in the science community, but if scientists lead this instead of ARM, they may need ASR support because of the time required. Is this possible?
  - Dedicated time and resources are needed by an already overburdened ARM radar engineering and science team, especially in the implementation and testing of automated algorithms. Is this possible?