A proposal for a

2009 ARM Precipitation IOP

Who? Mike Jensen (BNL) Pavlos Kollias (BNL)
Tony Del Genio (GISS) Jim Mather (PNNL)
and hopefully many more

When? May – June 2009

Location? ARM SGP

Motivation

" We propose to turn more attention to precipitation….the amount of liquid being removed from the atmosphere is a key link to the radiation budget " (Warren Wiscombe, ARM Chief Scientist Proposal, 2005)

"We need to evolve beyond the artificial state where we deal with clouds and precipitation as separate chain of events of the water cycle" (Graeme Stephens, CPWG meeting 2005, Annapolis, MD)

"SGP precipitation IOP – evaluation of 2d and extension to 3d rain rate retrievals using existing instrumentation and guest instrumentation (precip radar, disdrometers, etc.)" (Deep Clouds Summary, CPWG meeting 2005, Annapolis, MD)

"…rather small changes in a model's convective precipitation efficiency can generate changes comparable to those observed (in TOA radiative fluxes from 1984-2001)" (Clement and Soden, 2005)

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 Intiation

3) Updraft/Downdraft Dynamics

4) Condensate Transport/Detrainment

5) Precipitation/Cloud microphysics

6) Influence on environment

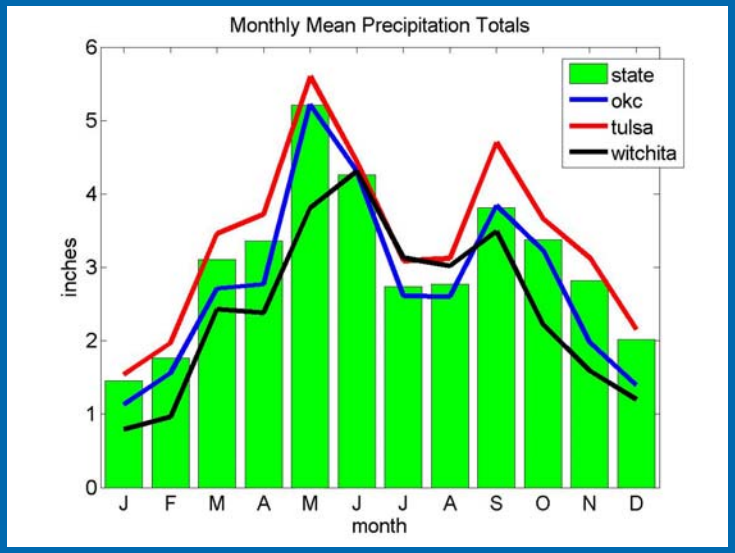
7) Influence on Radiation

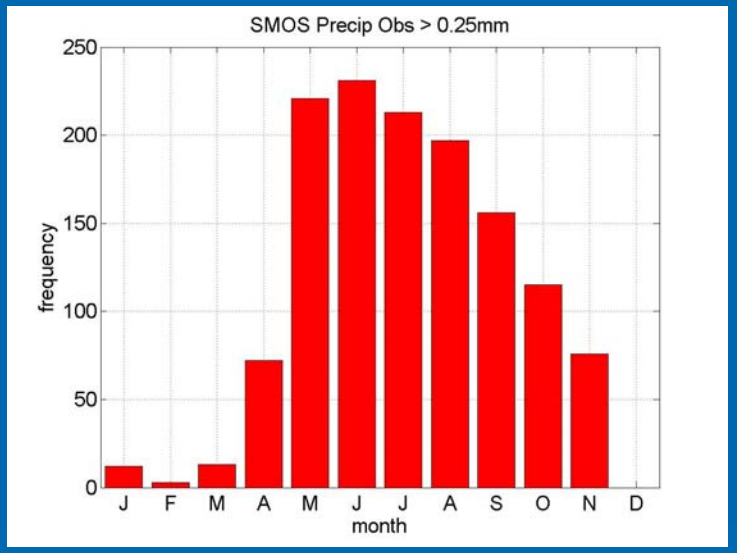
8) Large-scale forcing

Big Question: Given PBL (T,q) and vertical profiles, can the precipitation at the ground be predicted?

When? May-June 2009

3 figures (1 OK climatological survey, 2. SMOS rain gauge data, 3. MMCR)





Surface Remote Sensing (Radar) based approach

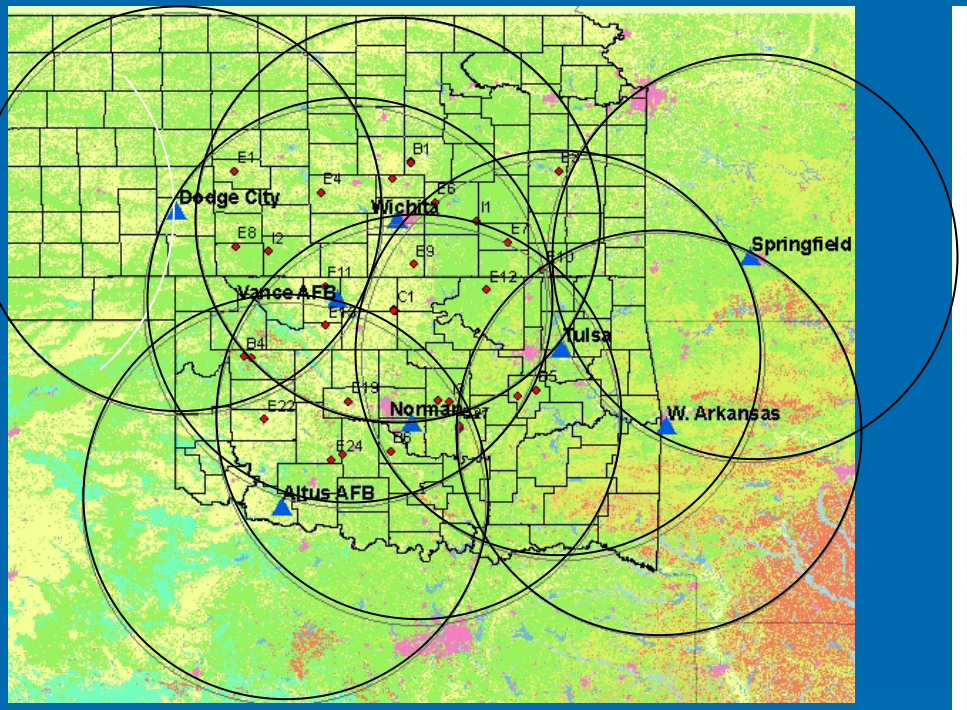
A combination of:

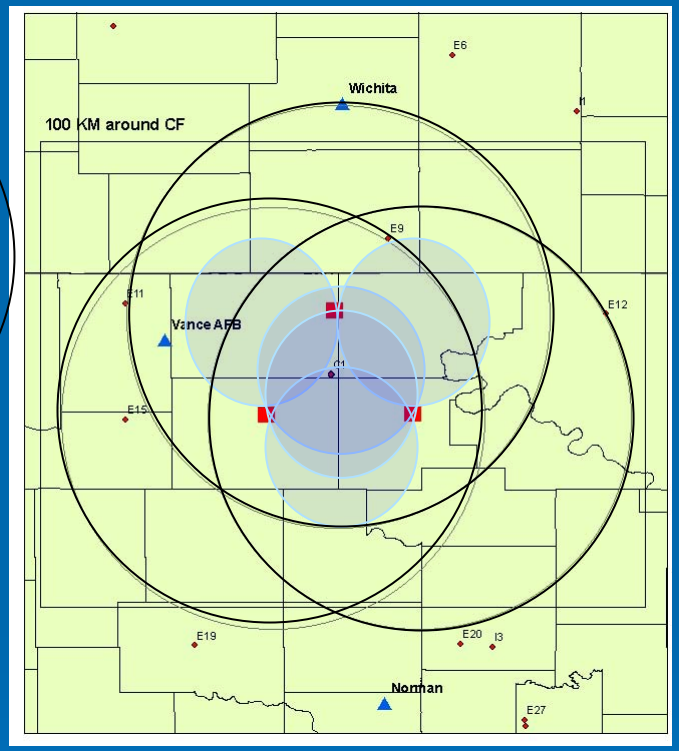
1. ARM-funded IOP measurements
2. Routine non-ARM data resources
3. ARM external datasets
4. Routine ARM observations
5. Externally funded IOP measurements

To measure several quantities important for the consideration of convective parameterization and cloud-resolving model simulations

Centerpiece: Radar Remote Sensing

Multi-scale and Multi-frequency





NEXRAD Network

Area I : Cloud/Precipitation

Tri-Doppler and Profiling

Updraft/Downdrafts and Cloud μ-physics

X-band network (proposed)

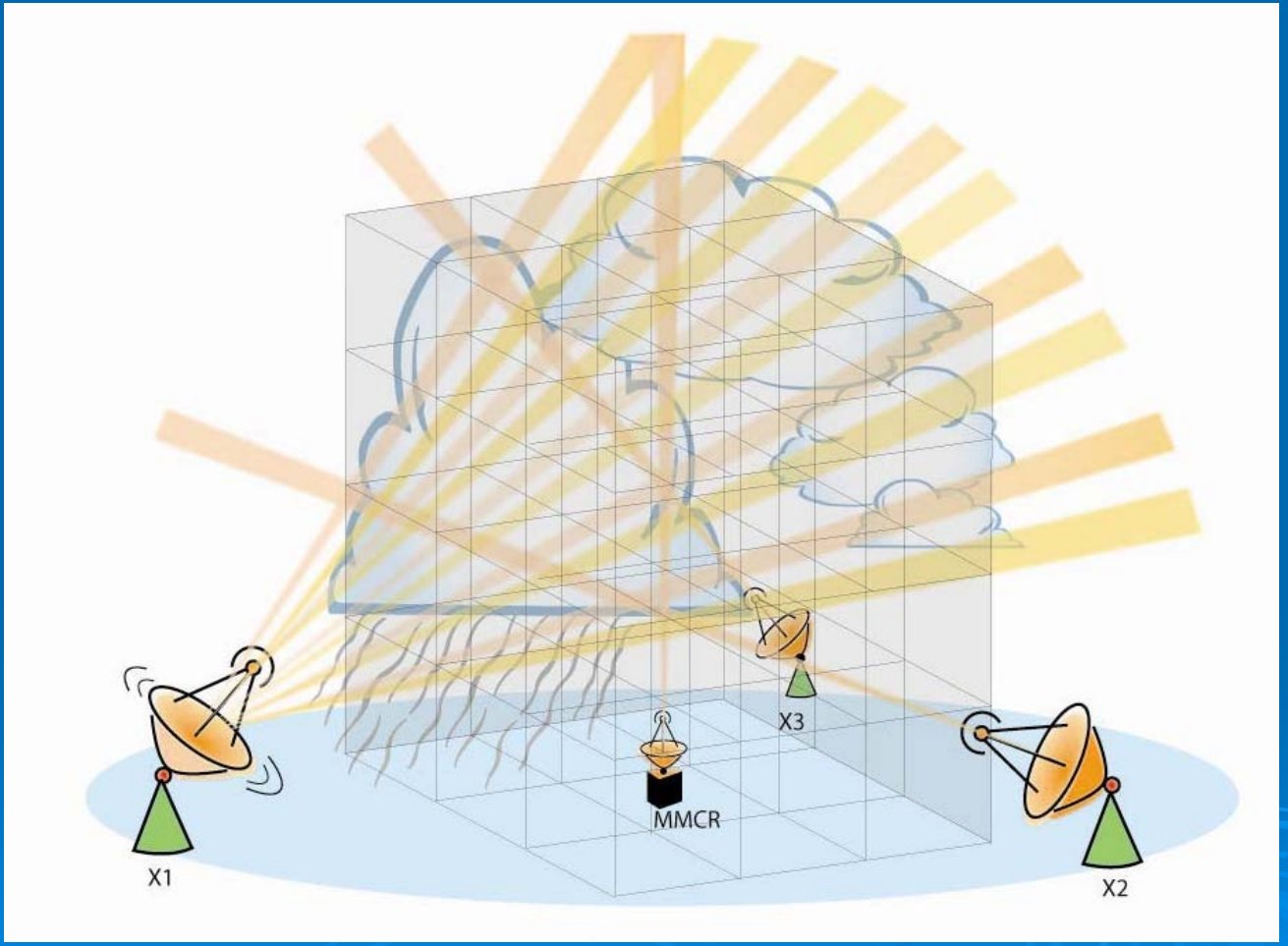
Area II: Dual Doppler

Convergence/Divergence

Cloud/Precip. Morphology

Scanning Radar array

- Scanning procedure to best resolve cloud physics and atmospheric dynamics at CRM cloud scales



Come to Pavlos' talk on Thursday to learn about future of radar observations for CRM/GCM applications

Candidate instruments and what they provide(1)

1) Pre-convective environment
2) Convective Intiation
3) Updraft/Downdraft Dynamics
4) Condensate Transport/Detrainment
5) Precipitation/Cloud microphysics
6) Influence on environment
7) Influence on Radiation
8) large-scale forcing

Instrument	Quantities Observed	Conv. Param Elements
Scanning [X-band] radars (3, guest)	Cloud/Precip properties, Updraft/downdraft structure	2,3,4,5
MIPS (UAH, guest)	BL vertical structure, sfc. Rad., sfc. Met	1,6,7
Aerosonde (guest)	BL horizontal structure	1,6,7,8
Increased radiosondes (ARM)	Vertical profiles of atmospheric thermo	1, 6, 8

Candidate instruments and what they provide (2)

1) Pre-convective environment
2) Convective Intiation
3) Updraft/Downdraft Dynamics
4) Condensate Transport/Detrainment
5) Precipitation/Cloud microphysics
6) Influence on environment
7) Influence on Radiation

Instrument	Quantities Observed	Conv. Param Elements
Nexrad WSR-88D (non-ARM)	Large-scale precip.	4,5,8
OK Mesonet (external ARM)	Sfc. met	1,6,8
Disdrometers (ARM, guest)	Precip properties	5
MMCR (ARM)	Cloud properties	2,3,4,5

Action Items

We are soliciting an initial endorsement of this proposal from:

1. Cloud Parameterization and Modeling Working Group
2. Cloud Properties Working Group

This would lead to the presentation of a formal proposal to the ACRF Science Board

If we receive these endorsements we are also soliciting collaborators!