

Data Development in Support of ARM Modeling Activities

(CMWG Translator Report)

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ARM Cloud Modeling/Aerosol Working Group Meeting
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Overview

- **Climate Modeling Best Estimate (CMBE) data: current status and future plan**
- **Long-term continuous forcing at SGP and Darwin**
 - **Aaron Kennedy's talk on the comparison of NARR and ARM continuous forcing data at SGP**
- **Discussion on CMWG data issues**

New Additions to CMBE

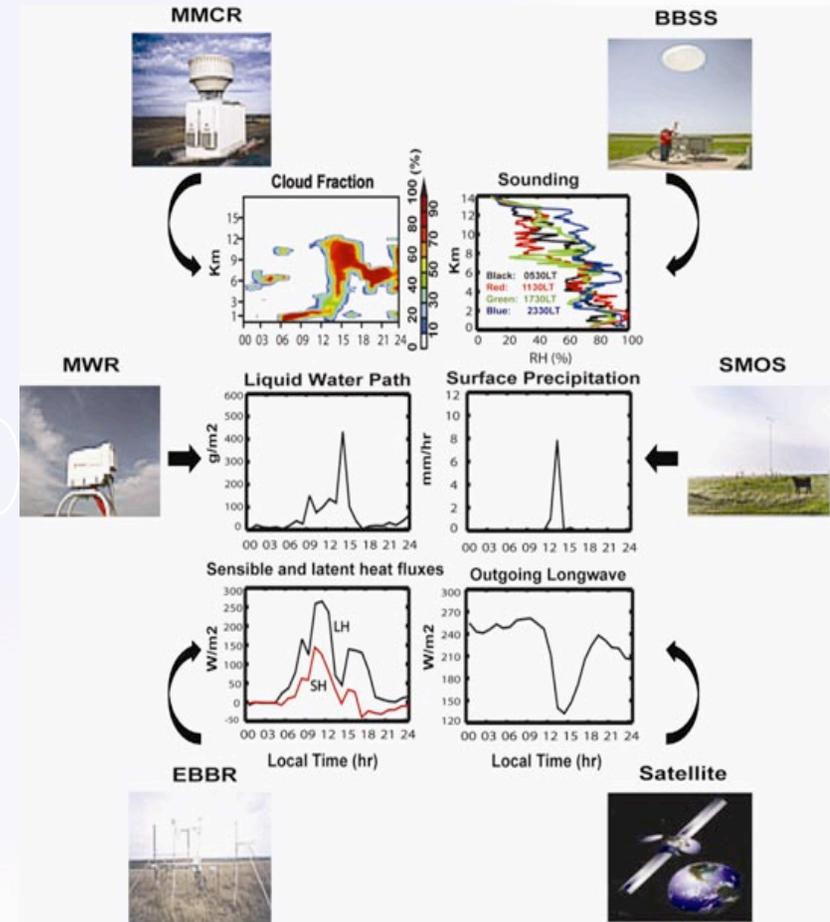
- Thank Renata McCoy for her great efforts!

■ CMBE-CLDRAD

- Cloud fraction profiles
- Total clouds
- LWP/PW
- Surface radiative fluxes
- TOA radiative fluxes (*New, SGP*)
- Satellite retrieved clouds (*New, SGP*)

■ CMBE-ATM (*New, SGP*)

- Soundings
- NWP analysis data
- Surface heat fluxes
- Surface precipitation
- Surface temp, RH, and winds



CMBE Data Availability

- **SGP-Lamont**
 - **CMBE-CLDRAD: 1996-2009**
 - **CMBE-ATM: 1993-2008**
- **NSA-Barrow**
 - **CMBE-CLDRAD: 1998-2007**
- **TWP-Manus:**
 - **CMBE-CLDRAD: 1996-2007**
- **TWP-Narau:**
 - **CMBE-CLDRAD: 1998-2007**
- **TWP-Darwin:**
 - **CMBE-CLDRAD: 2002-2007**

Future Plan on CMBE Data

- Enhance CMBE for NSA and TWP sites
 - CMBE-ATM
 - Satellite data to CMBE-CLDRAD
- RIPBE – Radiatively Important Parameters Best Estimate
(RPWG, Sally McFarlane)
 - Cloud microphysical properties
 - Aerosol properties
 - Surface albedo
- CMBE – area-mean data (SGP)
 - *from long-term continuous forcing data*
- Surface soil measurements to CMBE
- Statistical summary data from CMBE and RIPBE
 - Diurnal cycle climatology
 - Annual cycle climatology

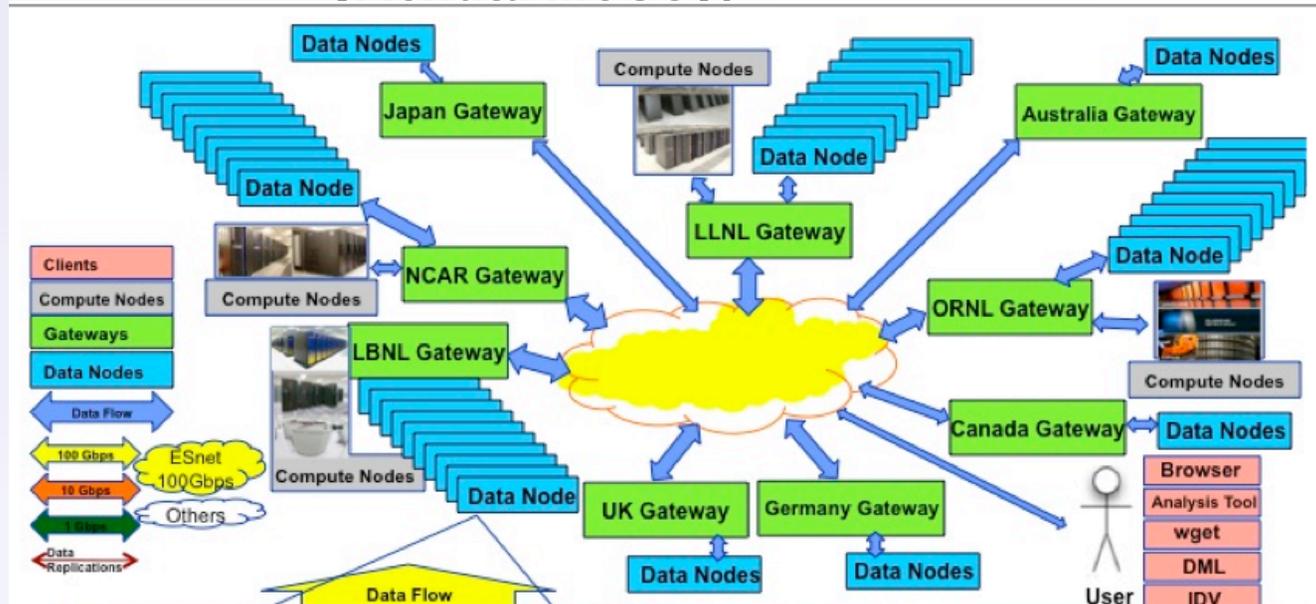
Adding ARM data to ESG

(Renata McCov)

ARM Data:

CMBE
Forcing Data

Also CAPT Data



ESG: Earth System Grid

The ESG is the next generation infrastructure that enables distributed data analysis through sharing of climate model output data (IPCC and other) and observational data sets

- Loose federation of data nodes and gateways

<http://www.earthsystemgrid.org/>

<https://esg.llnl.gov:8443/> (IPCC data)

Long-Term Continuous Forcing Data

- **Extend the long-term forcing data (1999-2001) at SGP to recent years (Ongoing, LLNL)**
 - (RUC analysis constrained by surface and TOA observations through the variational analysis)*
 - Ranked 1st by CMWG 18 months ago
 - Support RACORO field campaign and CMBE data development (area-mean quantities)
 - Quality of the ARM forcing is higher than current analysis or re-analysis data (NARR vs. ARM by Aaron Kennedy)
- **Develop long-term forcing at TWP-Darwin (Monash University, Christian Jakob)**
 - (ECMWF analysis constrained by radar rainfall estimates from C-POL through the variational analysis)*
 - Christian Jakob's group has produced the forcing data for the 05/06 and 06/07 wet seasons.
 - If radar rainfall estimates are available, the forcing for the 07/08 wet season will be produced, too.

Aaron Kennedy's Talk:

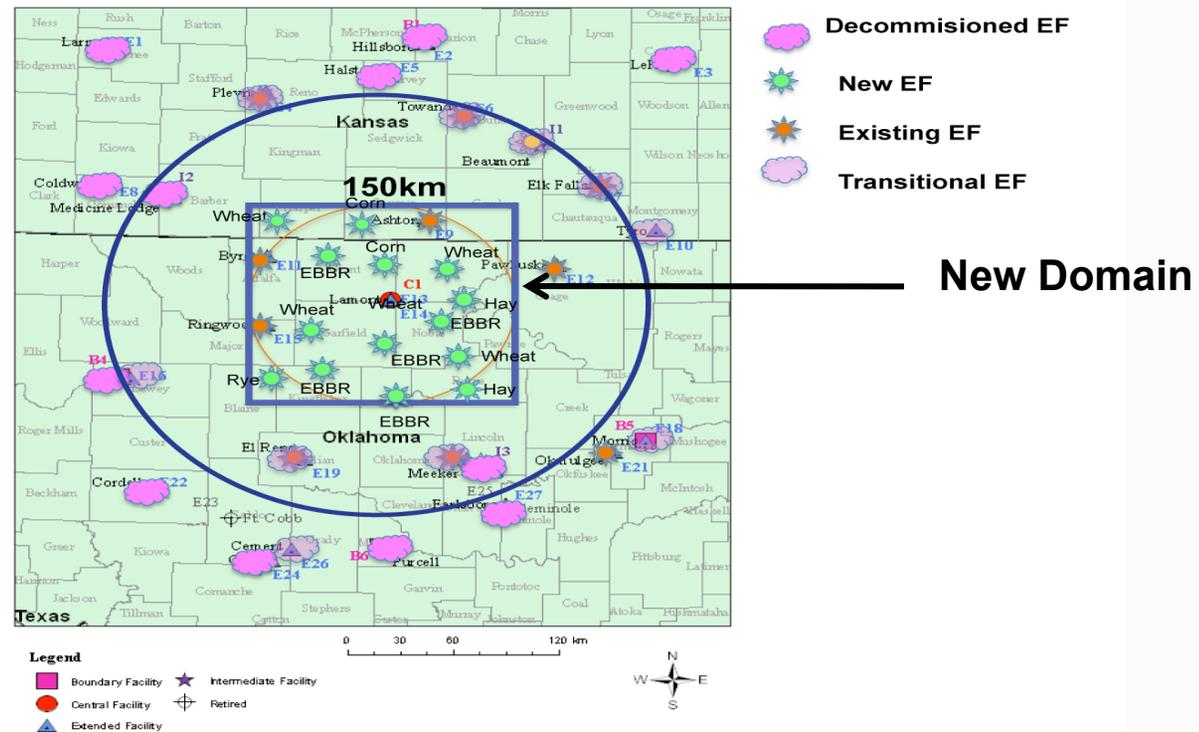
**Relationships of observed cloud fractions to
ARM continuous forcing and NARR at the
ARM SGP**

Discussion on CMWG Data Issues

- **Large-scale forcing dataset**
 - **Continuous forcing data**
 - **Forcing for a reduced SGP domain**
 - **Forcing for AMF deployments (Azores, China, etc..)**
- **Integrated data product**
 - **CMBE**
 - **BBHRP**
- **New data products**
 - **Best estimate of cloud microphysical properties**
 - **Cloud retrievals under precipitating conditions**
 - **Vertical velocity at the cloud scale**
 - **What can we expect from the new instruments: 3d clouds?**

The SGP Domain Reduced

- ACRF is shrinking SGP to a smaller domain (150x150 km) with increased density of surface stations
- Two forcing datasets will be generated for future IOPs: one at current domain and one at the reduced domain



AMF Azores Deployment

(5/1/2009-31/12/2010)



Clouds, Aerosol, and Precipitation in the Marine Boundary Layer
(CAP-MBL)

- *Should we perform the variational analysis for selected cases from this deployment?*

Add a precipitation radar to AMF????

Tell us what do you need for this AMF or other AMF deployments

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BBHRP - Sally McFarlane

Runs Currently Processed:

- SGP**
 - Processed 6 years of ver1.5 at SGP**
 - 200103-200602**
- NSA Intercomparison**
 - Processed 2 years at NSA (2004-2005) using Microbase and Shupe-Turner cloud retrievals**
 - Data will be archived as evaluation product**
- CLOWD-BBHRP Intercomparison**
 - Using BBHRP to evaluate retrieval algorithms for CLOWD-type clouds at Pt Reyes**
 - Have calculated heating rates and fluxes for one month at Pt Reyes for five different retrieval algorithms**
 - Data will be archived as evaluation product**

Do We Need a Best Estimate of Cloud Microphysical Properties?

Various cloud microphysical retrievals for LWC/IWC, but not available for all periods and all ARM sites

- **MICROBASE: LWC/IWC, Liquid/ice particle effective radius**
 - SGP: 1998 – 2007; NSA: 2002 – 2007; TWP-Manus: 2000 - 2004
- **J. Mace's cloud properties, radiative fluxes, and radiative heating rates**
 - SGP: 1997 – 2004
- **J. Mather's cloud properties and radiative heating rates**
 - TWP sites (????)
- **G. Liu's 3d IWC: SGP March 2000 IOP, TWPICE, satellite retrieved data**
- **Cloudnet Project Data (Robin Hogan)**
 - Available for NIM, FKB, Cabauw, Chilbolton, Lindenberg, Palaiseau, potenza, **but not for ARM permanent sites**
- **M. Shupe's retrievals (not in archive)**
- **Z. Wang's retrievals (not in archive)**

Do We Need a Best Estimate of Cloud Microphysical Properties?

- *What accuracy is need?*
- *Is it possible to run all (or selected) existing algorithms for all sites and all periods so that we can make a comparison?*

BBHRP – A Testbed for Evaluating Cloud Retrievals

- a slide taken from Sally McFarlane

Flux closure is a metric for evaluating cloud retrievals

- Agreement in observed/calculated fluxes is an indirect metric of trust in retrieved cloud properties
- Statistical analysis over large numbers of cases can show trends in retrieval performance
- BBHRP was used to evaluate initial candidate algorithms for Microbase
- Being used by Shupe, Turner to evaluate Arctic cloud retrievals
- Similar framework being used by Comstock/McFarlane/Protat to evaluate ice cloud retrievals
- Used in CLOWD – BBHRP intercomparison (Comstock et al.) to evaluate algorithms for thin liquid water clouds

Caveats: BBHRP should not be the only metric for retrieval evaluation!

- will have difficulty evaluating retrievals for some cloud types
- is only an indirect metric of cloud properties

Cloud Retrievals Under Precipitating Conditions

- Information obtained from 2009 CPWG fall meeting

- **3-channel MWR (23.8, 30, and 89GHz):** the new channel helps retrieve LWP under light and moderate rain condition (*Maria Cadeddu*)
- **Scanning polarimetric K- and W-band radars:** (Sergey Matrosov)
 - Will provide 3D structure of cloud macro- and microphysical parameters
 - Will provide a means for identification of ice hydrometeor habits and estimation of their shapes (in snowfall and ice clouds)
 - Will provide a means for sizing snowflakes/ice particles in precipitating and non-precipitating thick ice clouds based on K/W dual frequency ratio
- **Longer wavelength radars (e.g., such as scanning polarimetric C,X-band radars, and/or profilers operating in a precipitation mode) collocated with cloud radars:** (Sergey Matrosov)
 - Will allow for improving the accuracy of separation between liquid cloud (suspended water) rainfall (precipitating water) (**W-band is essential**)
 - Will provide 3D structure of precipitation parameters around ARM sites

Vertical Velocity at the Cloud Scale

- Information obtained from 2009 CPWG fall meeting

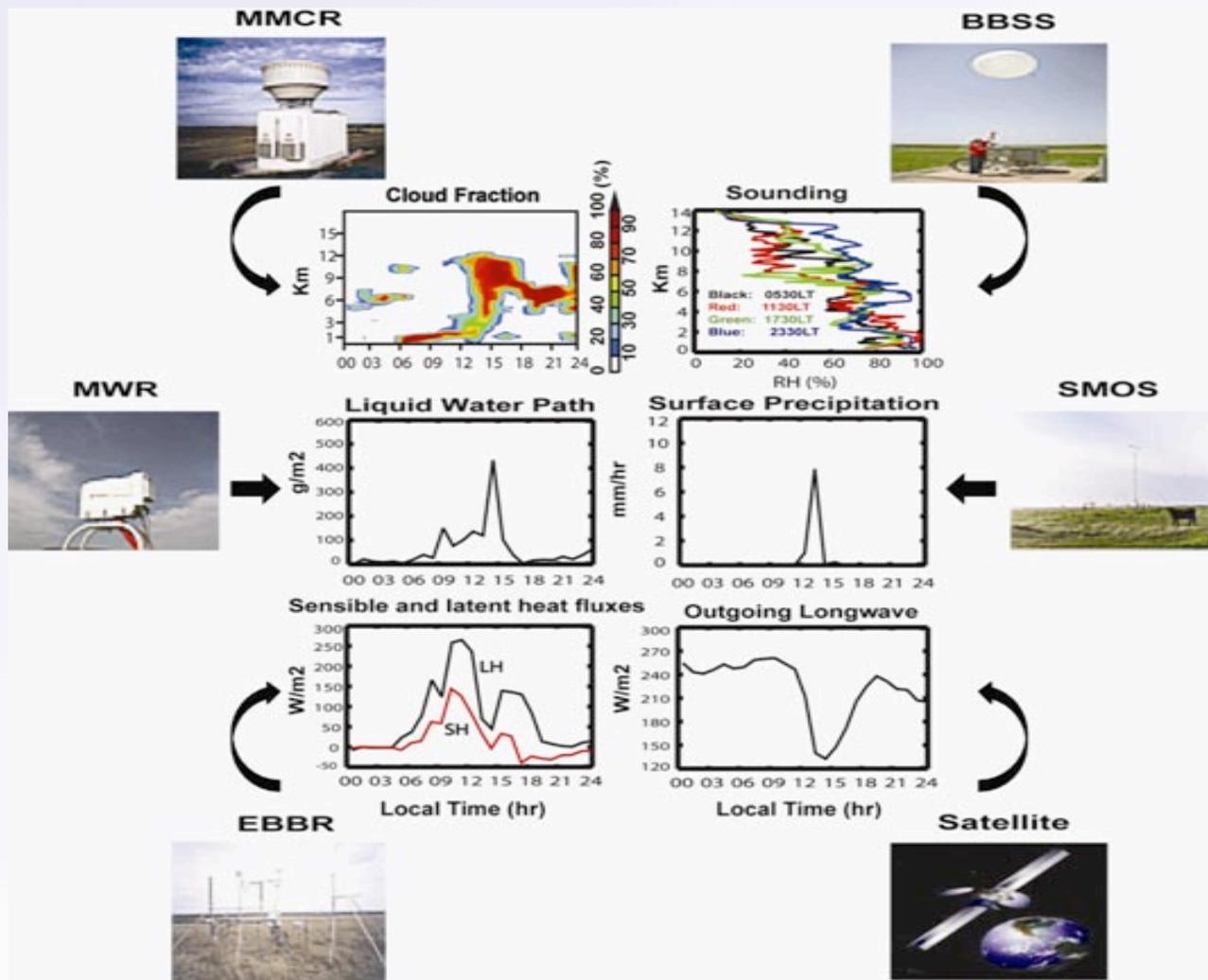
- **915 MHz wind profilers could be used for the measurements of vertical velocities in convective cloud systems**
- **Vertical velocity data for non-precipitating conditions from Pavlos Kollias.**

What can we expect from the new ACRF instruments?

- **3D clouds?**
- **Cloud retrievals under precipitating conditions?**
- **??????**

The END

CMBE – An Integrated Data Product

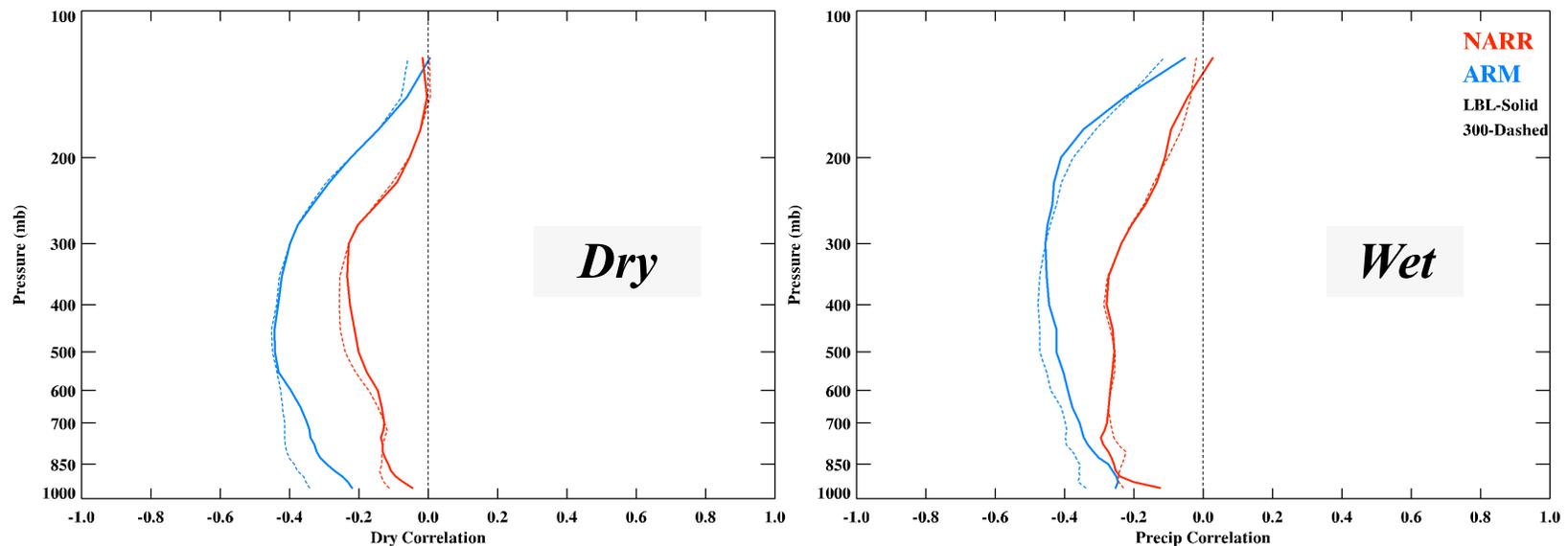


Long-Term Continuous Forcing Data

ARM vs. NARR

(Aaron Kennedy and Xiquan Dong)

3hr Omega Correlations for NARR and ARM



Three year (1999-2001) data at SGP