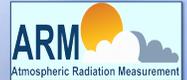


# Update on LLNL ARM Value-Added Products for Cloud Modeling Studies

R. B. McCoy, S. Xie, Y. Zhang, Q. Tang and X. Chen

Lawrence Livermore National Laboratory

Contact: [mccoy20@llnl.gov](mailto:mccoy20@llnl.gov)



## Introduction

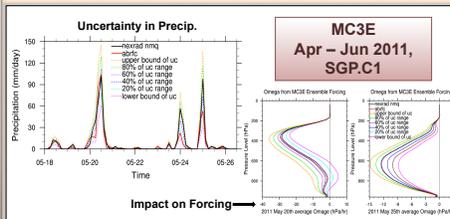
This poster presents new additions, updates and future plans for the cloud modeling Value Added Products (VAPs) being developed by the Lawrence Livermore National Laboratory (LLNL) ARM Infrastructure team.

These include:

- ARM Best Estimate**
  - NEW LAND VAP product (ARMBELAND),
  - AMF ARMBE for China and Azores IOPs
  - Updates to ARMBEATM and ARMBECLDRAD
- Large-Scale Forcing datasets**
  - Ensemble MC3E (22 Apr – 6 Jun 2011)
  - High res. 150km domain RACORO (May 2009)
  - Updated AMIE-Gan (2 Oct – 13 Dec 2011)
- QCECOR VAP** transferred to main archives
- Updated ARM Cloud Retrieval Ensemble Dataset (ACRED)** and uncertainty quantification
- Future work**

## Ensemble MC3E Forcing

The ensemble forcing uses uncertainty range in precip. based on differences in two datasets: precipitation from Arkansas-Red Basin River Forecast Center (ABRFC) and bias-corrected NOAA NMQ NEXRAD precipitation (courtesy of S. Giangrande, BNL). The data represent an average over the analysis domains (300km) centered at CF.

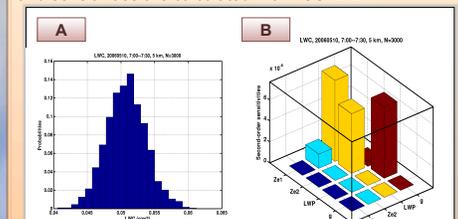


Data Download: [http://lop.archive.arm.gov/arm-lop/eval-data/xie/scm-forcing/lop\\_at\\_sgp/](http://lop.archive.arm.gov/arm-lop/eval-data/xie/scm-forcing/lop_at_sgp/)

## UQ in MICROBASE

Started adding error bars to Microbase. The following figures show examples

- Probability distribution function of average LWC (unit: g/m<sup>3</sup>) derived from MICROBASE at 5 km over SGP cite at May 10, 2006 7:00-7:30
- Second-order sensitivities of average LWC to the first two modes of Ze, LWP, and g at 5 km over SGP cite at May 10, 2006 7:00-7:30. LWC is derived using MICROBASE and sensitivities are calculated with PSUADE..

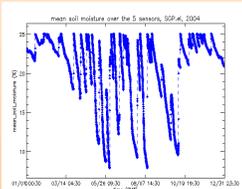


## ARMBE LAND

The ARMBELAND is a subset of the ARM Best Estimate products for supporting community land-atmospheric research and land model developments. It contains several critical soil quantities that ARM has been measuring for many years for describing land properties. The quantities in ARMBE-Land are averaged over one hour time interval, consistent with other ARMBE datasets.

It includes variables:

- Soil temperature (CO2FLX, EBBR, and SWATS)
- Soil moisture content (CO2FLX, EBBR and SWATS)
- Soil heat flux (CO2FLX, EBBR)
- CO2 flux (CO2FLX)
- CO2 density (CO2FLX)
- Friction velocity (CO2FX)
- Photosynthetic photon flux density (CO2FX)

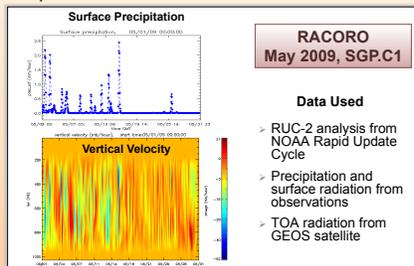


- Data availability:
- Quantities from CO2FLX : 2003-2012
  - Quantities from EBBR: 1994-2012
  - Quantities from SWATS: 1996-2012

Data Download: <http://lop.archive.arm.gov/arm-lop/eval-data/xie/armbe-eval/armbeland>

## High Res. RACORO Forcing

The high resolution (10mb) data over smaller domain (150km) is now available for RACORO IOP (May 2009).



RACORO May 2009, SGP.C1

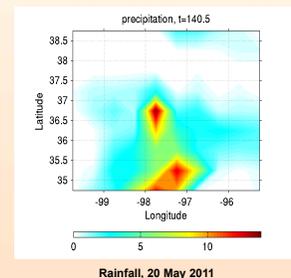
Data Used

- RUC-2 analysis from NOAA Rapid Update Cycle
- Precipitation and surface radiation from observations
- TOA radiation from GEOS satellite

## Future Goals

### ARMBE

- 2D gridded ARMBE (0.25x0.25 deg) for SGP
  - Surface fluxes, land properties, clouds, and TOA radiative fluxes
  - Data for MC3E is available per request



Rainfall, 20 May 2011

- ARMBE Land - move from evaluation to production
- Release ARMBE for AMF China and AMF Azores
- Add area-average ARMBE
- Add statistical ARMBE data
- ARMBE RIPBE

### Large-Scale Forcing

- Sounding based forcing data for DYNAMO IOP
- Ensemble forcing data for AMIE IOP

### QCECOR

- Extend to current with SEBS constraints

### ACRED

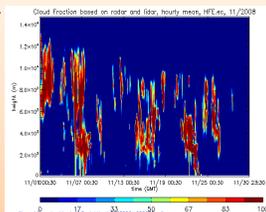
- High frequency ACRED
- Create ensemble MICROBASE cloud retrieval dataset

## AMF ARMBE

The AMF ARMBE is developed for the AMF China (HEF.M1) and Azores (GRW.M1).

The new cloud fraction algorithm has been developed using the arsc1-wacr datastream.

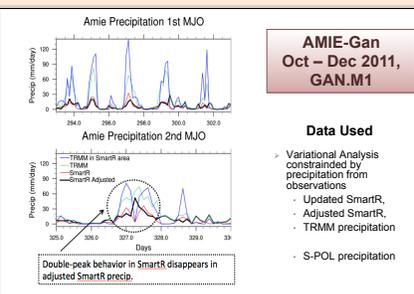
The data is in evaluation And will be available in April.



Cloud Fraction based on radar, lidar and ceilometer

## Updated AMIE-Gan Forcing

Large scale forcing data was developed for AMIE-Gan IOP covering 1<sup>st</sup> and 2<sup>nd</sup> MJO period (10/02/2011- 12/13/2011) constrained by adjusted and updated SMART-R, TRMM and S-POL precip. measurements to address uncertainties in surface rainfall, 150x150km domain, 3 hourly, 25mb.



AMIE-Gan Oct – Dec 2011, GAN.M1

Data Used

- Variational Analysis constrained by precipitation from observations
  - Updated SmartR,
  - Adjusted SmartR,
  - TRMM precipitation
- S-POL precipitation

## Acknowledgement

This work is supported by the DOE ARM program and the ASR Cloud Lifecycle Working Group. We would like to thank those who provided us the necessary data to develop these data products. Drs. M.Jin, Z.Li, B. Xi, X. Dong and A. Kennedy have made a considerable contribution to the ARMBE data development.