Update on ASR Climate Modeling Data Development at LLNL

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ARM Atmospheric Radiation Measurement

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:
1. Transition of the ARM showcase Climate Modeling Best Estimate (CMBE) to **ARM Best Estimate (ARMBE),**
2. **Large-scale forcing** datasets
   - MC3E (22 Apr – 6 Jun 2011)
   - SPARTICUS (1 Jan – 30 Jun 2010)
   - AMIE_Gan (13 Nov – 13 Dec 2011)
3. **New VAP** for ECOR turbulent fluxes (**QCECOR**)
4. Updated **ARM Cloud Retrieval Ensemble Dataset (ACRED).**
5. Upcoming new **ARMBE-Land** (see "Future Goals")

ARMBE

The former Climate Modeling Best Estimate (CMBE) was updated and transitioned to ARM Best Estimate (ARMBE) The updates include:
- New variables:
  - **surface clear sky radiative fluxes**, for calculating effective cloud albedo   (for SGP)
  - **latent and sensible heat fluxes from ECOR,** instrument (in addition to fluxes from BAEBBR).
- New **improved cloud fraction** algorithm that does not rely on ceilometer/lidar cloud base estimate that can be faulty when lidar is not working (mainly before 2000), *This change does not affect the cloud fraction when both lidar and radar are operational, which is the data we always recommend to use.*
- The **most recently reprocessed MWRRET** liquid water path, precipitable water.
- **The most recent surface and TOA radiative flux.**
- This data has now a **DOI number**

ARMBEATM:
NSA.C1: North Slope Alaska, Barrow, AK, 01/01/2001 - 12/31/2011
SGP.C1: Southern Great Plains, Lamont, OK, 01/01/1994 - 12/31/2012
TWP.C1: Tropical Western Pacific, Manus Island, PNG, 01/01/1996 - 12/31/2011
TWP.C2: Tropical Western Pacific, Nauru Island, 01/01/1998 - 12/31/2011
TWP.C3: Tropical Western Pacific, Darwin, Australia, 01/01/2002 - 12/31/2011
ARMBECLDRAD:
NSA.C1: North Slope Alaska, Barrow, AK, 01/01/1998 - 12/31/2010
SGP.C1: Southern Great Plains, Lamont, OK, 01/01/1996 - 12/31/2010
TWP.C1: Tropical Western Pacific, Manus Island, PNG, 01/01/1996 - 12/31/2010
TWP.C2: Tropical Western Pacific, Nauru Island, 01/01/1998 - 12/31/2010
TWP.C3: Tropical Western Pacific, Darwin, Australia, 01/01/2002 - 12/31/2010

http://www.arm.gov/data/vaps/armbe

ARMBE DOI Numbers & Reference

ARMBE data has a **DOI number** and should be referenced by it.
Data Reference and Download:
   sgparmbecldrd.C1   DOI: 10.5439/1039926
   sgparmbeatm.C1   DOI: 10.5439/1039931
   download and more info   http://www.arm.gov/data/vaps/armbe
Xie, S., R.B. McCoy, S.A. Klein , et al., 2010: Clouds And More: ARM Climate Modeling Best Estimate Data. *Bull. Amer. Meteor. Soc.*, 91, 13–20. doi:10.1175/2009BAMS2891.1

MC3E Multiscale Forcing

The multiscale-domain forcing data with improved sounding was updated for domains centered at central facility with a diameter of **300 km**, **150 km** and **75 km.**
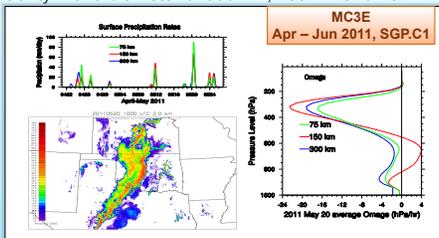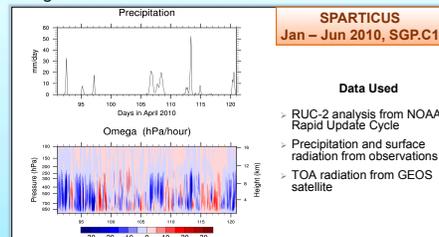

MC3E Apr – Jun 2011, SGP.C1

Data Download:
   http://iop.archive.arm.gov/arm-iop/0eval-data/xie/scm-forcing/iop_at_sgp/

SPARTICUS Forcing

The large-scale forcing data is available for SPARTICUS IOP covering the period **1/1/2010 to 6/30/2010**. This is an average over the domain of 300km centered at SGP CF.


SPARTICUS Jan – Jun 2010, SGP.C1

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

Data Download:
   http://iop.archive.arm.gov/arm-iop/0eval-data/xie/scm-forcing/continuous_at_sgp/2010/

AMIE-Gan Forcing

Large scale forcing data was developed for the AMIE-Gan IOP over the **2nd MJO period (11/13/2011- 12/13/2011)** covering the S-POL area analysis domain. The data is 3-hourly and has 25 mb vertical resoluiton.
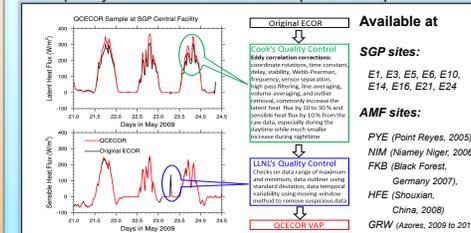

AMIE-Gan Nov – Dec 2011
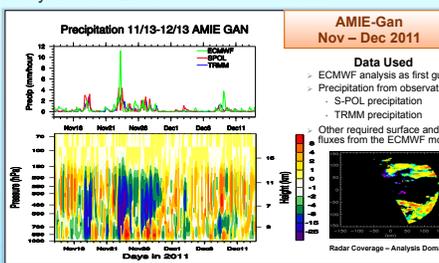
Data Used
- ECMWF analysis as first guess
- Precipitation from observations
  - S-POL precipitation
  - TRMM precipitation
- Other required surface and TOA fluxes from the ECMWF model

QCECOR

New quality controlled ECOR data (**QCECOR**).

Original ECOR

Cook's Quality Control
Eddy correlation corrections: coordinate rotations, time constant, delay, stability, Webb-Pearman, frequency, sensor separation, high pass filtering, line-averaging, volume-averaging, and outlier removal, commonly increase the latent heat flux by 10 to 30 % and sensible heat flux by 10% from the raw data, especially during the daytime while much smaller increase during nighttime

LLNL's Quality Control
Checks on data range of maximum and minimum, data outliner using standard deviation, data temporal variability using moving window method to remove suspicious data

QCECOR VAP

Available at

SGP sites:
E1, E3, E5, E6, E10, E14, E16, E21, E24

AMF sites:
PYE *(Point Reyes, 2005),*
NIM *(Niamey Niger, 2006),*
FKB *(Black Forest, Germany 2007),*
HFE *(Shouxian, China, 2008)*
GRW *(Azores, 2009 to 2010)*

Data Download: http://iop.archive.arm.gov/arm-iop/0eval-data/xie/qcecor/

ACRED

The **ARM Cloud Retrieval Ensemble Dataset** (ACRED) contains eleven hourly averaged cloud retrieval products for 5 ARM research sites. Cloud properties include LWP, LWC, liquid re, IWP, IWC, ice re, and cloud optical depth. Table shows the data availability.
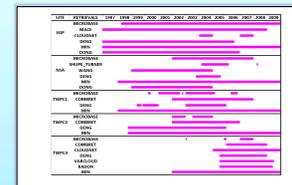
Data Download and Reference
   http://iop.archive.arm.gov/arm-iop/0eval-data/xie/acred/
Zhao C., S. Xie, S. Klein, et al. 2012: Toward understanding of differences in current cloud retrievals of ARM ground-based measurements, *J. Geophys. Res.*, 117, D10206, doi:10.1029/2011JD016792.

Future Goals

- **ARMBE**
  - **ARMBE Land** - preliminary dataset based on CO2FLX, EBBR, SWATS was already developed and contains:
    - Soil temperature, soil moisture, soil heat flux
    - CO_2 concentration and density
    - photosynthetic photon flux density
  - Create ARMBE for AMF China and AMF Azores
  - Add area-average ARMBE
  - Add statistical ARMBE data
  - ARMBE RIPBE
- **Large-Scale Forcing**
  - Ensemble forcing for MC3E IOP
  - Forcing data for AMIE IOP
- **QCECOR**
  - Extend to current with SEBS constraints
- **ACRED**
  - High frequency ACRED
  - Create ensemble MICROBASE cloud retrieval dataset

Acknowledgement

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