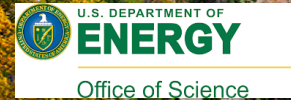


Update on ARM Data-oriented Diagnostics Package for GCM Evaluation

Chengzhu Zhang and Shaocheng Xie, LLNL

Thanks to: Laura Riihimaki, Connor Flynn, Justin Monroe, Shuaiqi Tang,
Professor Neelin's group at UCLA, Peter Gleckler, Charles Doutriaux,
Zeshawn Shaheen, Chris Golaz, and Dean N. Williams



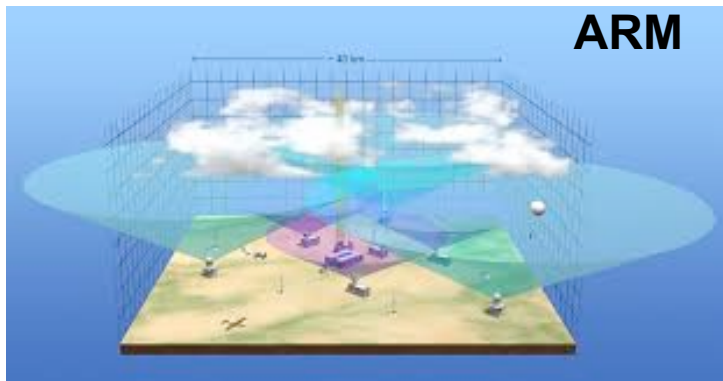
LLNL-PRES-725979



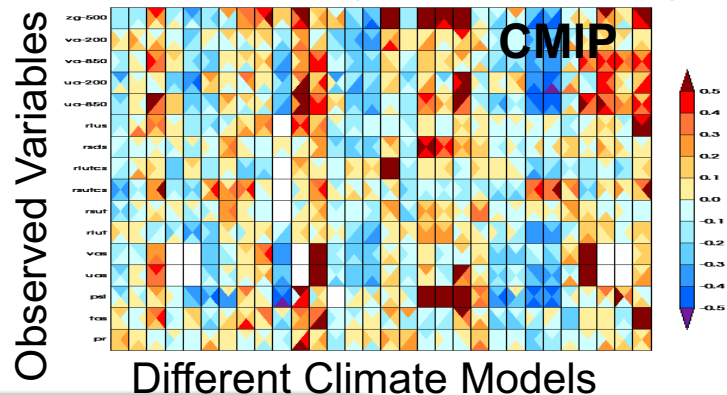
Introduction: ARM Data-oriented Diagnostics Package

Goal: Facilitate the use of high value ARM data in climate model evaluation and model inter-comparison.

Continuous measurements of radiation, clouds, aerosols, atmosphere, land...

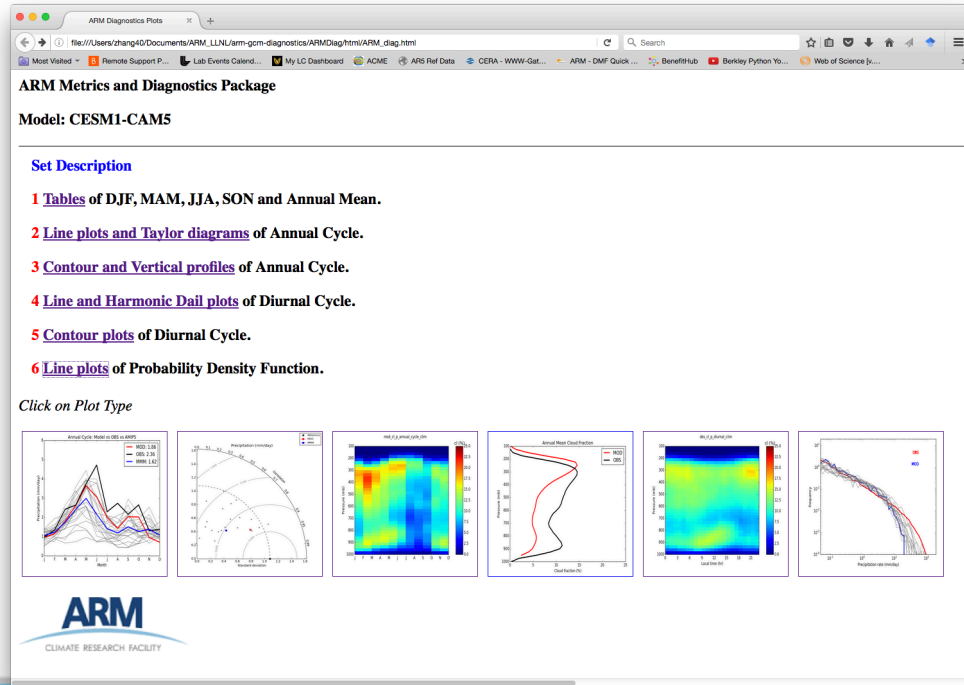


Archived CMIP data to enable model inter-comparison (ESGF, PCMDI)



Where we were?

- Basic observed variables processed to comply with CMIP convention
- Python toolkit assembled for file I/O, metrics calculation, graphics, generating web interface...



New development

I. New code structure

- Community Diagnostics Package

II. Expanded variable list

- Modified sensible and latent heat fluxes
- Aerosol optical depth
- Soil moisture content

III. Process oriented metrics

- Convective onset statistics (UCLA)



I. Code refactor toward CDP : Community Diagnostics Package (ESGF funded)

Configuration
management

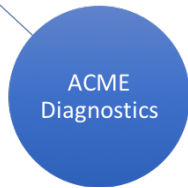
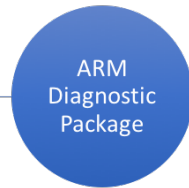
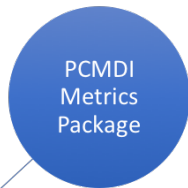
Metrics
calculation

Parallelization

Output viewer

Provenance
capture...

A Unifying Framework



- **Goal:**

- ❖ Effectively interact with other model diagnostics efforts in DOE.

- **Benefits:**

- ❖ Modular and object-oriented in design
- ❖ Flexible to implement new diagnostics

- **Status:**

- ❖ Configuration:
 - Load user input
- ❖ Execution
 - Optional command line parser are implemented in same fashion for three projects

Contributors: Zeshawn Shaheen, Chris Golaz, Charles Doutriaux, Dean N. Williams and Peter Gleckler

II. Expand variable list

- Consider the scale gap between local measurements and global models
- Consider observational data uncertainty and limitation, i.e., variable measured by different instruments



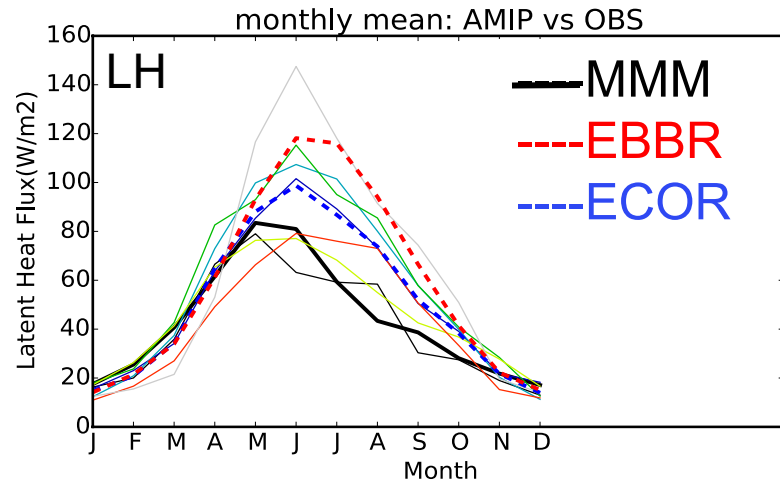
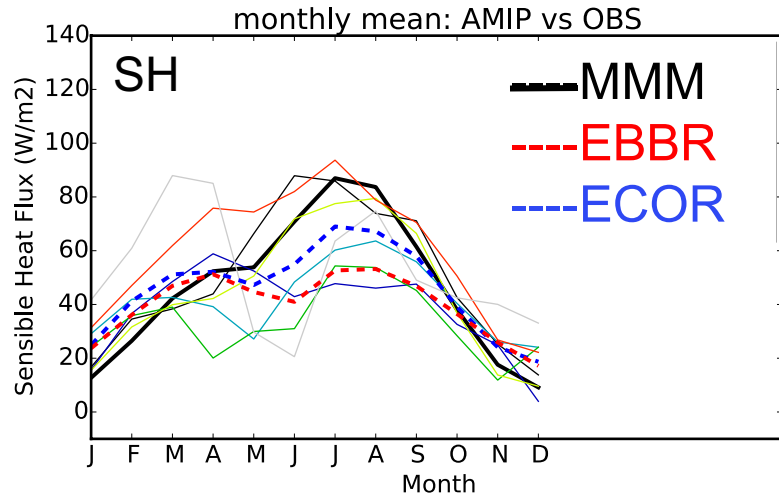
New variables: SH and LH fluxes

EBBR v.s. newly processed ECOR product.

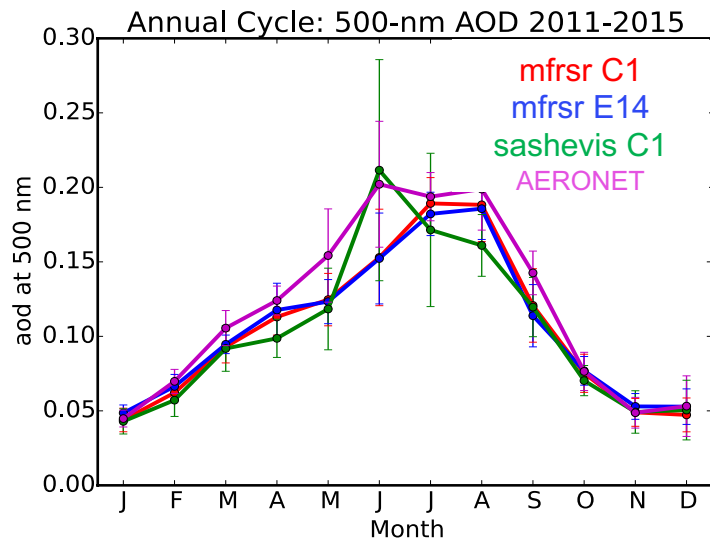
Difference between EBBR and ECOR: Different location and land surface type

8 EBBR stations: grass land

6 ECOR stations: various agriculture area and planting systems



New variable: Aerosol Optical Depth at 550 nm



- Use AOD comparison tool from Data Quality Office
- **mfrsr** has better availability and QC, than **sashevis**
- Convert AOD at 415-615 nm to AOD at 550 nm

Contributors: Laura Riihimaki,
Connor Flynn, Justin Monroe



III. Process oriented metrics

- Goal: Make use of the process-oriented metrics developed by scientists using ARM/ASR data for the GCM community
- Approaches to collaboration:

Collaborators provide: pre-processed observational data or pre-processing guide,
analysis modules (ideally in python)

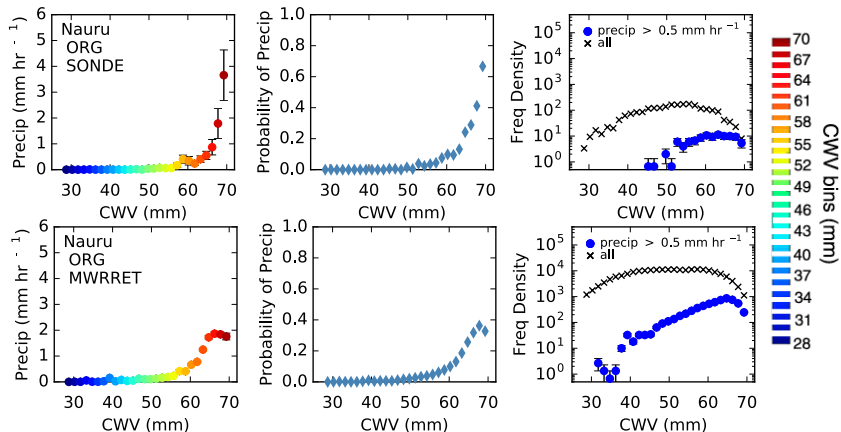
We provide: easy interface for importing modules, flexible for updating modules or adding dependencies by scientists.



Convection onset metrics (UCLA group)

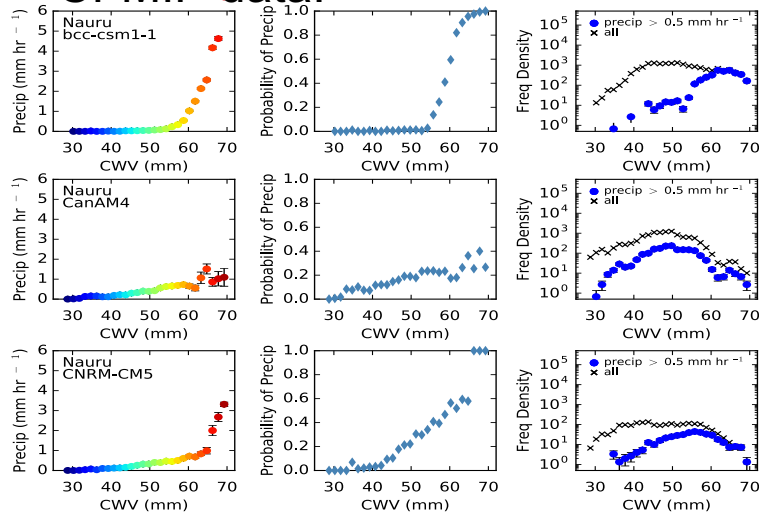
ARM data: Nauru

(Schiro et al. 2016)



- Statistics are instruments depended

CFMIP data:



Plan after basic metrics implemented:

- Satellite retrieval/reanalysis for resolution dependency
- Quantify temperature dependency
- Moisture vertical structure

Contributors: Kathleen Schiro, Yi-Hung Kuo, Baird Langenbrunner, Christian Martinez, Fiaz Ahmed and Professor David Neelin



Ongoing work and plan

- **Prepare for v1 release of data and codes by end of April**
- **Evolve package jointly with CDP**
- **Finish the implementation of convection onset metrics**
- **Integrate other process-oriented metrics**
- **Maintain a repository (GitHub) for community-contributions**

