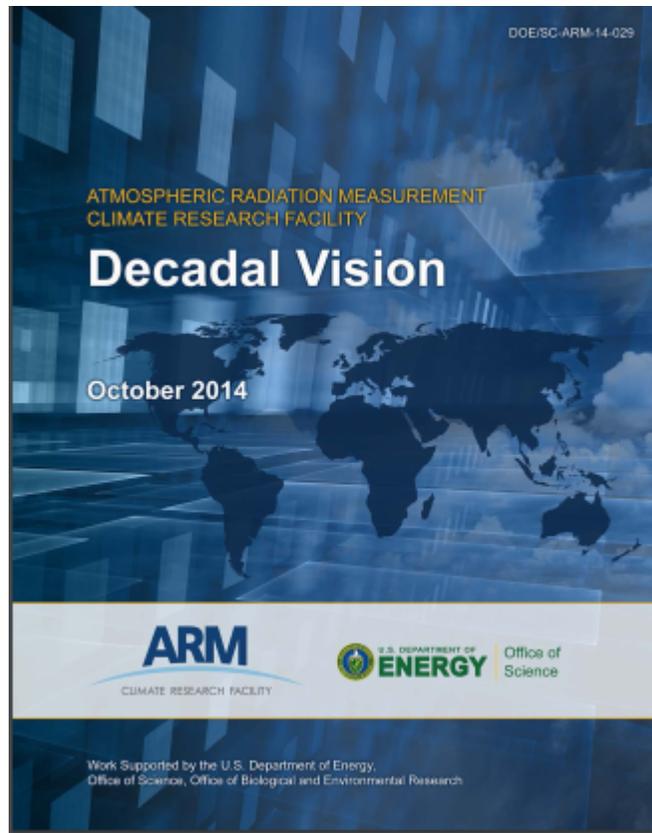




The Atmospheric Radiation Measurement (ARM) User Facility

JIM MATHER
ARM TECHNICAL DIRECTOR
Pacific Northwest National Laboratory (PNNL)

Serving the Science Community

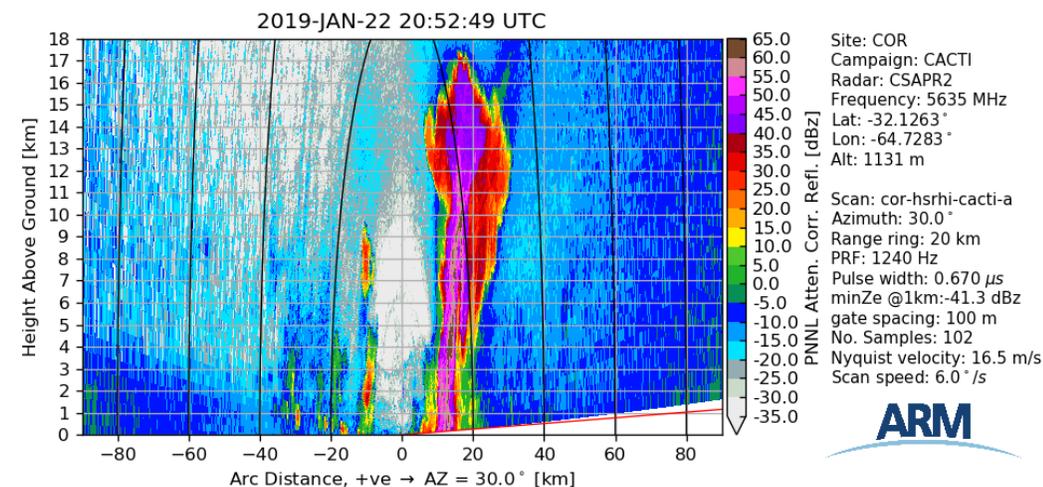


Focus areas from the 2014 plan:

- ▶ Enhance measurement excellence
- ▶ Enhance data products & processes
- ▶ Establish observation/modeling framework beginning with the SGP
- ▶ Strengthen interactions with the user community

New Measurements

- ▶ Scanning C-band precipitation radar (first deployed for CACTI (Argentina; N. Bharadwaj and the radar engineering team)
- ▶ Frozen precipitation properties at the North Slope of Alaska (J. Delamere, M. Sturm, M. Stuefer)
- ▶ Tethered Balloon and Unmanned Aerial measurements at Oliktok with thermodynamic, aerosol and supercooled liquid water content (D. Dexheimer and F. Mei)
- ▶ Tethered Balloon activities under development to add aerosol filter sampling in collaboration with the Environment Molecular Science Laboratory (EMSL) (with F. Mei and S. China)



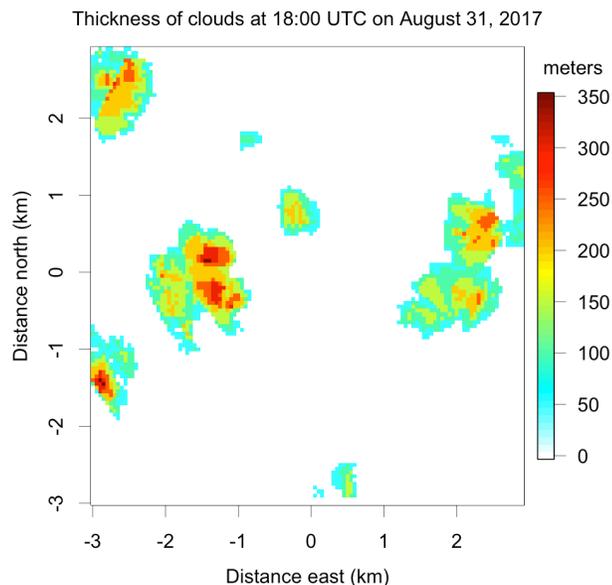
*Courtesy J. Hardin
and N. Bharadwaj*



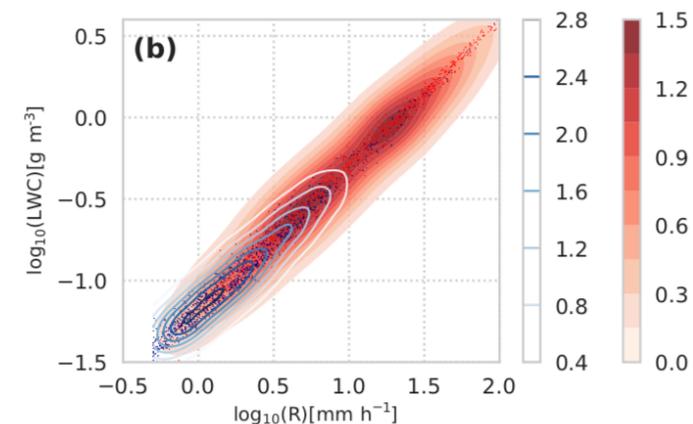
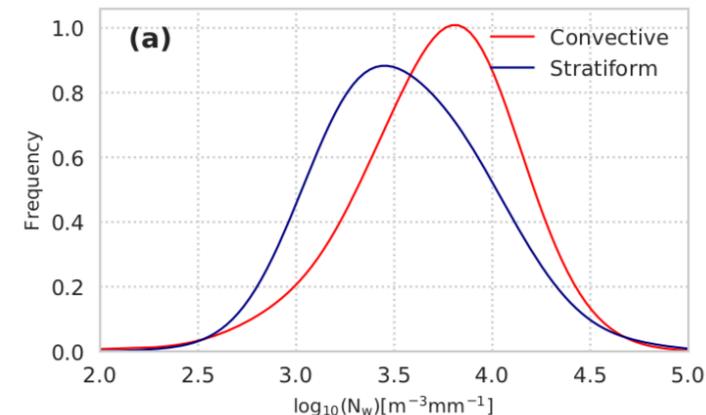
Compact aerosol
filter sampler

Data Products and Related Activities

- ▶ Release of PARSQUANTS – precipitation VAP using Disdrometers. Available at SGP, ENA, CACTI, GOAMAZON (Giangrande and Hardin)
- ▶ Evaluation data available for COGS stereo photogrammetry cloud fields at SGP (Romps and Oktem)
- ▶ ARMBE at NSA extended through Oct. 2018 (was previously only up through 2010; Xie)
- ▶ Excellent progress on VAPs for AMF deployments (Translators)
- ▶ Radar ingests complete or in final review (Hardin and radar team)



Courtesy D. Romps and R. Oktem



Wang et al., 2018

How do I make best use of these measurements?



[DATA](#) ▾

[CAPABILITIES](#)

[RESEARCH](#) ▾

[NEWS & EVENTS](#) ▾

[ABOUT](#) ▾

Atmospheric Observatories

Instruments

VAPs

Modeling

Computing Resources

ATMOSPHERIC RADIATION MEASUREMENT USER FACILITY

CONNECT WITH ARM

[CREATE ACCOUNT](#)

[ORGANIZATION](#)



POLICIES

[DATA POLICIES](#)

[CAMPAIGN GUIDELINES](#)

[LINKING POLICIES](#)

[PRIVACY & SECURITY NOTICE](#)

HELP

[ASK US](#)

[DATA QUESTIONS](#)

[FAQS](#)

[ACCOUNT MANAGEMENT](#)

RESOURCES

[MEDIA](#)

[OUTREACH](#)

[ACRONYMS](#)

[GLOSSARY](#)

WORKING WITH ARM

[USE ARM FACILITIES](#)

[ACKNOWLEDGE ARM](#)

[SUBMIT A PROPOSAL](#)

[FIND EMPLOYMENT](#)

How do I make best use of these measurements?

CONNECT WITH ARM

ORGANIZATION

TECHNICAL DIRECTOR

[Jim Mather](#)

TECHNICAL ADMINISTRATOR

[Kim Stewart](#)

ASSOCIATE DIRECTOR FOR OPERATIONS

[Nicki Hickmon](#)

ENGINEERING AND SCIENCE PRODUCTS LEAD

[Jennifer Comstock](#)

DATA AND COMPUTING SERVICES

[Giri Prakash](#)

COMMUNICATIONS AND MEDIA

[Hanna Goss](#)

MAILING ADDRESS

Atmospheric Radiation Measurement (ARM) user facility
Pacific Northwest National Laboratory
P.O. Box 999
MS K9-38
Richland, WA 99352 USA
509-375-2111

ADDITIONAL CONTACTS

[U.S. Department of Energy](#)
[Technical Director's Office](#)
[Associate Director for Operations](#)
[Engineering and Process Management](#)
[Communications and Media](#)
[Infrastructure Management Board \(IMB\)](#)
[Science Board](#)
[ARM-ASR Coordination Team \(AACT\)](#)
[Architecture and Services Strategy Team \(ASST\)](#)
[Atmospheric Observatories](#)
[Instrument Mentors](#)
[ARM Data Center](#)
[Data Quality Office](#)
[Cyber Security](#)
[Constituent Groups](#)
[Translators](#)
[LASSO](#)

Translators

ARM "Translators" manage the development of Value Added Products (VAPs) and serve as liaisons between ARM and the science community.

Current translators

- ▶ Shaocheng Xie (LLNL): Products supporting modeling; lead
- ▶ Scott Collis (ANL): Products from precipitation radars/PyART
- ▶ Scott Giangrande (BNL): Clouds and thermodynamics
- ▶ John Shilling (PNNL): Aerosols



ADDITIONAL CONTACTS

U.S. Department of Energy

Technical Director's Office

Associate Director for Operations

Engineering and Process Management

Communications and Media

Infrastructure Management Board (IMB)

Science Board

ARM-ASR Coordination Team (AACT)

Architecture and Services Strategy Team (ASST)

Atmospheric Observatories

Instrument Mentors

ARM Data Center

Data Quality Office

Cyber Security

Constituent Groups

Translators

LASSO

Instrument Mentors

Mentors are the primary point of contact for questions pertaining to their respective instruments. Roles and responsibilities include:

- ▶ Transfer of instruments to operations
- ▶ Calibration and oversight of maintenance
- ▶ Assessment of data quality
- ▶ Management of repairs, upgrades, and replacements
- ▶ Engagement with the user community

<https://www.arm.gov/connect-with-arm/organization/instrument-mentors>

ADDITIONAL CONTACTS

U.S. Department of Energy

Technical Director's Office

Associate Director for Operations

Engineering and Process Management

Communications and Media

Infrastructure Management Board (IMB)

Science Board

ARM-ASR Coordination Team (AACT)

Architecture and Services Strategy Team (ASST)

Atmospheric Observatories

Instrument Mentors

ARM Data Center

Data Quality Office

Cyber Security

Constituent Groups

Translators

LASSO

Instrument Mentors



The ARM Data Center



DATA ▾

CAPABILITIES

RESEARCH ▾

NEWS & EVENTS ▾

ABOUT ▾

Atmospheric Observatories

Instruments

VAPs

Modeling

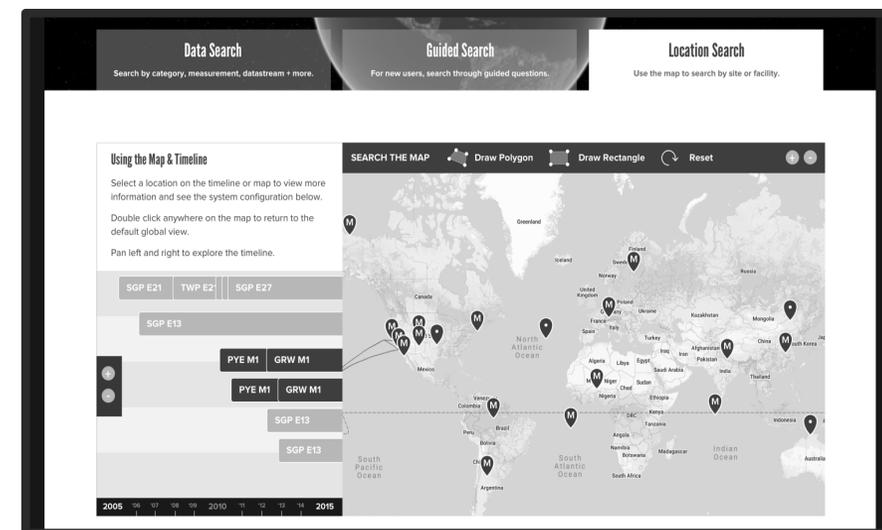
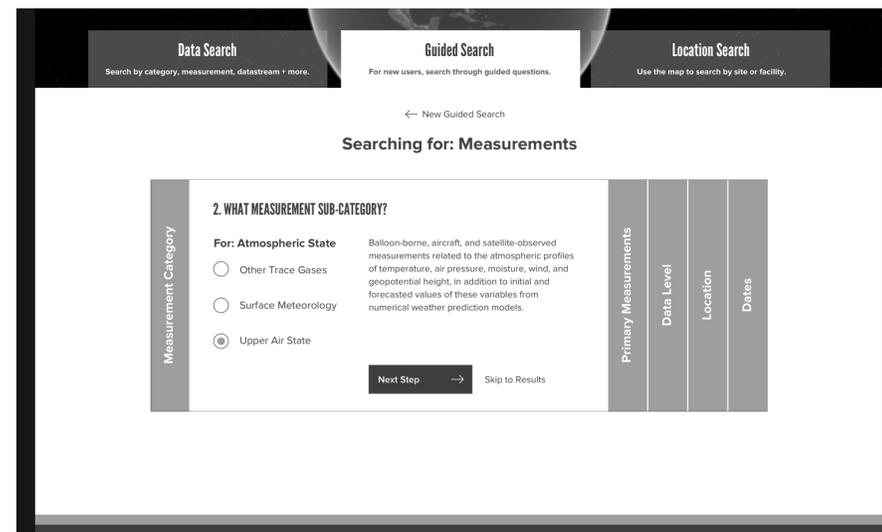
Computing Resources

Data Discovery Upgrade

Based on triennial review recommendations, stakeholder recommendations, usage patterns, and usability testing

Key Feedback:

- ▶ Reduce the number of search results to new users by using recommended data sources.
- ▶ Simplify data search results and the user interface
- ▶ Make searches more intelligent (by including recommended sources, broader ontologies etc..)
- ▶ Centralize metadata information to be cleaner and easier to find
- ▶ Provide guided and spatial search for new/novice users
- ▶ Ease the transition between arm.gov and data discovery
- ▶ My Accounts page with access to order history



Data Discovery Upgrade



HOME
DATA SEARCH
SUPPORT
LOGIN
CART

Sort by: A-Z Collapse Filters

Exclude Filters with 0 Matches

SEARCH BY DATE RANGE

Start Date to End Date

Categories 6

- Aerosols 115
- Atmospheric Carbon 24
- Atmospheric State 508
- Cloud Properties 604
- Radiometric 224
 - Longwave Broadband 101
 - Longwave Narrowband 93
 - Longwave Spectral 20
 - Macrophysical 1
 - Microwave 7
 - Optical & Radiative Properties 2
 - Shortwave Broadband 120
 - Shortwave Narrowband 47
 - Shortwave Spectral 20
 - Surface/subsurface State 1
 - Upper Air State 1
- Surface Properties 109

Datastreams 1,000+

Measurements 135

Enter New Search + Key

Search Results - Showing 1-20 of 47 datastreams

(5) Filters Applied [Clear All](#)

Datastreams (311) Primary Measurements (474) Recommended Data (47) All Data (311) Sort by: Newest to Oldest 20

Datastream	Description	VIEW ALL
QCRADLONG	Surface Radiation Measurement Quality Control Testing, including chronologically configurable limits.	VIEW ALL
QCRADBEFLUXLONG	Surface Radiation Measurement Quality Control Testing, including chronologically configurable limits.	VIEW ALL
Tags: Golden Epoch Hilly	Tropical Western Pacific: Central Facility, Magnus I., PNG	<input type="checkbox"/>
<input checked="" type="checkbox"/> SGP <input checked="" type="checkbox"/> TWP <input checked="" type="checkbox"/> NSA	Tropical Western Pacific: Central Facility, Nauru Island	<input type="checkbox"/>
+ 6 More	Tropical Western Pacific: Central Facility, Darwin, Australia	<input type="checkbox"/>
	Southern Great Plains: Central Facility, Lamont, OK	<input type="checkbox"/>
	Southern Great Plains: Tyro, KS (Extended)	<input type="checkbox"/>
	Southern Great Plains: Byron, OK (Extended)	<input type="checkbox"/>
QCRADBRSLONG	Surface Radiation Measurement Quality Control Testing, including chronologically configurable limits.	VIEW ALL
MFRSRAOD1MICH	Surface Radiation Measurement Quality Control Testing, including chronologically configurable limits.	VIEW ALL
ARMBEZDGRID	Surface Radiation Measurement Quality Control Testing, including chronologically configurable limits.	VIEW ALL
MFRSRAOD1MICH	Surface Radiation Measurement Quality Control Testing, including chronologically configurable limits.	VIEW ALL

CELOMETER ★

(corceiM1.b1)

Tags: Golden Epoch Hilly

Description:
The ceilometer (CEIL) is a remote-sensing instrument that measures cloud height, vertical visibility, and potential backscatter signals by aerosols. It detects up to three cloud layers simultaneously. Operating through a maximum vertical range of 7700 m, the CEIL transmits near-infrared pulses of light and the receiver detects the light scattered back by clouds and precipitation.

Location: Cordoba, Argentina; Mobile Facility (CACTI) // AMF1

Category: ARM Science Products

Source Instrument: Ceilometer (CEIL); cloud-base heights

Data Processing Level(s): b1

DOI: 10.5439/1181954

Start Date: 2018-09-24

End Date: 2019-03-13

Map **Satellite**

Data Timeline & Quality

2005 06 07 08 09 2010 11 12 13 2015 16 17 18 2019

Golden Epoch

Data Plots

[+ MORE](#)

Primary Measurements **Data Object Design**

VARIABLES:

Backscattered radiation: Variable: Backscatter (backscatter)

Cloud Based Height: Variable: Lowest cloud base height detected (first_cbh)

Instrument Contacts: Victor Morris [Contact](#)

Additional Resources: Instrument Handbook [Campaign Information](#) [DG Zoom](#) [Submit Feedback](#) [Related Publications](#) [DG Plots](#)

Actions: [Visualize Data](#) [Tag this Data](#) [Add to Cart](#)

ARM Data Center Computing Facility



Stratus cluster

- ▶ 30 nodes
- ▶ 1,080 cores
- ▶ Complex data product development
- ▶ No-SQL based advanced visualizations



Cumulus cluster

- ▶ 112 nodes
- ▶ 4,032 cores
- ▶ LASSO model operations & large scale data analysis/visualizations

- ▶ Heterogeneous computing resources available
- ▶ Direct access to 1.7 Petabytes of ARM data allowing users to perform long-term data analysis
- ▶ Recently deployed open source data science tools including Jupyter Hub and Dask.
- ▶ HPC code optimization help is available from ARM Data Center

CAPABILITIES > COMPUTING RESOURCES

REQUEST ACCESS TO THE ARM CLUSTER

REQUESTER

Who is making this request?

- Enter your last name and click search
- Select your name from the list that appears

More information at:

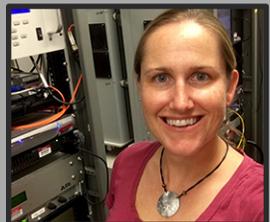
www.arm.gov/capabilities/computing-resources

Contact Giri Prakash

User Executive Committee



Sebastien Biraud
LBNL



Allison Aiken
LANL



Christine Chiu
Reading



Jiwen Fan
PNNL



Graham Feingold
NOAA/ESRL



Dan Feldman
LBNL



Scott Giangrande
BNL



Xiaohong Liu
U. Wyoming



Max Maahn
U. Colorado



Courtney Schuamcher
Texas A&M



Art Sedlacek
BNL



Adam Varble
PNNL



Paquita Zuidema
U. Miami

Activities over past year:

- ▶ Engaging with the broader science community
- ▶ Enhancement of Data Discovery
- ▶ Development of tutorials
- ▶ Feedback to the BER Advisory Committee (BERAC)
- ▶ Advancing uncertainty assessments

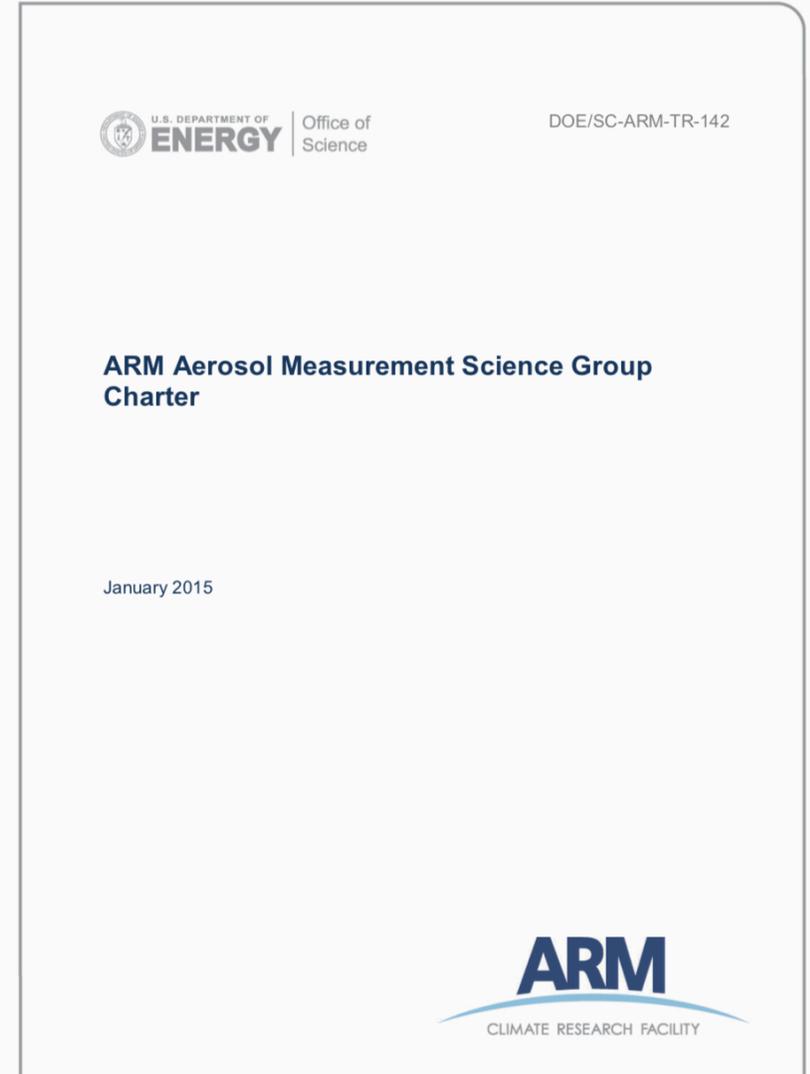


Other Constituency Groups



- ▶ Aerosol Measurement and Science Group
- ▶ Clouds and Precipitation Measurement and Science Group

Providing an interface between ARM and the ARM user community to facilitate communication and improve the effectiveness of ARM measurements and data products.



Aerosol Measurements and Science Group

Members:

- ▶ Allison McComiskey (chair)
- ▶ Jerome Fast
- ▶ Connor Flynn (mentor)
- ▶ Chongai Kuang (mentor)
- ▶ Tim Onasch
- ▶ Nicole Riemer (WG co-chair)
- ▶ Mike Ritsche (site operations)
- ▶ Art Sedlacek (mentor)
- ▶ John Shilling (translator)
- ▶ Jim Smith (WG co-chair)
- ▶ Alyssa Sockol (DQ office)
- ▶ Stephen Springston (mentor)
- ▶ Adam Theisen (instrument lead)

AMSG activities include:

- ▶ ~Monthly teleconferences
- ▶ Breakout sessions at ARM/ASR annual meeting (Monday)
- ▶ A 2017 workshop that led to an aerosol measurements plan
- ▶ A follow-on workshop tentatively planned for later this year

Clouds and Precipitation Measurements and Science Group

Members:

- ▶ Ann Fridlind (chair)
 - ▶ Nitin Bharadwaj (mentor)
 - ▶ Christine Chiu
 - ▶ Scott Collis (translator)
 - ▶ Scott Giangrande (translator)
 - ▶ Mike Jensen (WG chair)
 - ▶ Matt Kumjian
 - ▶ Paytsar Muradyan (mentor)
 - ▶ Rob Newsom (mentor)
 - ▶ Alyssa Sockol (DQ office)
 - ▶ Matthew Sturm
-
- ▶ The CPMSG is the newest constituency group (1st meeting in April)
 - ▶ Breakout session on Wednesday
 - ▶ A workshop tentatively planned for later this year

Planning the Next Phase for the LES ARM Symbiotic Simulation & Observation (LASSO)



- ▶ Suggestions collected over past 18 months through meetings and surveys.
- ▶ Workshop held in May to review options for next phase. Options under consideration:
 - Marine Clouds/Eastern North Atlantic
 - Central Arctic and North Slope of Alaska
 - Deep continental convection
 - Stable boundary layers

Contact Bill Gustafson and Andy Vogelmann

Another opportunity for connecting measurements and models, the E3SM Single Column Model:

<https://github.com/E3SM-Project/scmlib>

Updating the ARM Strategic Plan



Focus areas from the 2014 plan:

- ▶ Enhance measurement excellence
- ▶ Enhance data products & processes
- ▶ Establish observation/modeling framework beginning with the SGP
- ▶ Strengthen interactions with the user community

Use input from community and ARM staff to develop updated plan in 2020

ARM Activities at this Meeting

- ▶ Tuesday
 - Networking lunch with User Executive Committee (UEC)
- ▶ Wednesday
 - Introduction to the new Data Discovery design
 - Learning to use Social Media for science applications
- ▶ Throughout the week
 - Data booth for help with on-line ARM resources