

ARM Data Center Help Desk – throughout the meeting

Taking a break? Waiting for your session to start? The ARM Data Center (ADC) staff will be available to help! The Help Desk is happy to answer questions and discuss all the amazing resources we provide to our users. You can learn how to:

- submit your data to the ARM Data Center as a PI Product
- search, order, and access ARM data
- generate advanced visualizations of ARM data
- request special data
- create data citations using DOIs
- find data usage metrics
- request ADC computers and clusters for your computationally intensive research
- leverage advanced tools to help analyze ARM data

During your visit, please provide your feedback on how to improve ARM Data Services. ARM Data Center Help Desk will be actively working during the morning, breaks, and evenings to help you.

Contact: [Giri Prakash](#)

Monday, June 10, 9:00 am – 11:30 am, Tutorial

Tutorial – Using ARM compute resources to do CESD science at scale

Conveners: Jitu Kumar and [Scott Collis](#)

Description: ARM collects many large datasets that are difficult to download and require substantial computing infrastructure for analysis. To this end ARM has substantial heterogenous computing resources available to users and stakeholders. In addition the ARM Data Center has been investing in implementing high quality open source data science tools such as Jupyter Hub and Dask. This tutorial, which will cater to a spectrum of skill levels, has the aim of equipping attendees with a set of techniques to distribute analysis tasks to many computational cores. The course will be taught using the Python programming language and will draw from a range of data available in the ARM archive. ADC developed tools for automation of ordering and staging will also be covered with a focus on server-side analysis.

Advance sign-up is required. Since this tutorial, held on the Monday morning before the main meeting, will be tailored to the audience, spaces are limited and will be offered on a first come first served basis. Those attending MUST plan to stay the Sunday night before unless travelling locally. If you wish to attend please fill out the following survey:

https://docs.google.com/forms/d/e/1FAIpQLSe6RtZ7FJCrKAd-sXlboKlThTMdvbA-2EJyyHX6cXWL6KLjvw/viewform?usp=sf_link

Agenda:

9:00 AM - 9:15 AM	Introduction to ARM HPC facility and resources	(Jitu Kumar)
9:15 AM - 9:45 AM	Refresher for Python and Jupyter	(Bobby Jackson)
9:45 AM - 10:15 AM	ARM data movement and staging	(Jitu Kumar)
10:15 AM - 10:45 AM	Parallel computing in Python using Dask	(Scott Collis)
10:45 AM - 11:00 AM	Hands on session: Simple examples using ARM data	(Jitu Kumar)
11:00 AM - 11:30 AM	Hands on session: Advanced examples using ARM data	(Scott Collis)

Monday, June 10, 1:30 pm – 3:30 pm, Breakout Session 1

Advancing the Use of ARM Observations for Large-Scale Earth System Model Development

Conveners: Katia Lamer, Daniel Feldman, Jiwen Fan, and Shaocheng Xie

Description: While ARM observations can prove invaluable to ensure adequate representation of atmospheric processes in large-scale models, their scale often differs greatly from that of large-scale models such that they may not be representative of grid-box simulated quantities. This breakout session will, by discussing product development and cross-discipline uncertainty, present current efforts to advance the use of ARM data both for testing large-scale models, such as the Earth System Model, and for charting a course towards improved fidelity in their representation of atmospheric and land-atmosphere interaction processes. Because the approaches for Earth System Model development and ARM data analysis and product development differ so substantially, the session will also leave time for an open discussion to strengthen existing paths and establish new ones to work in tandem with Earth System Model developers to identify where observations can be optimally deployed to reduce model errors and improve model parameterizations.

Agenda:

- 1:30-1:40 Introductory remarks
- 1:40-1:50 Comparison of vertically pointing and scanning observations for the retrieval of domain average light precipitation rate – Katia Lamer
- 1:50-2:05 Using CPOL data as an observational target for E3SM – Robert Jackson
- 2:05-2:20 Evaluation of simulated convective cloud system and precipitation using ARM data in combination with NEXRAD and GPM data – Jiwen Fan
- 2:20-2:35 Evaluation of parameterizations of mesoscale convective organization in Earth System Models – Daehyun Kim
- 2:35-2:50 ENA observations of boundary layer clouds and atmospheric condition relationships: application to CAM6 evaluation – Catherine Naud
- 2:50-3:05 Experiences with LASSO and CMDV-MCS for Bridging the Observation–Model Divide – William Gustafson
- 3:05-3:30 Discussion

Clouds, Aerosols, and Complex Terrain Interactions (CACTI)

Conveners: Adam Varble and Joe Hardin

Description: This session will overview the recently completed Cloud, Aerosol, and Complex Terrain Interactions (CACTI) ARM field campaign. CACTI involved deployment of the AMF-1 and C-SAPR2 between October 2018 and April 2019 to the Sierras de Cordoba mountain range of central Argentina with the G-1 aircraft gathering measurements on 22 flights between November 4th and December 8th. CACTI objectives include quantifying the sensitivity of orographic cumulus, congestus, and deep convective cloud processes and properties to surrounding environmental thermodynamic, kinematic, and aerosol conditions with one particular focus on deep convective initiation and upscale growth controls that were frequently observed during the experiment. Discussions will focus around datasets collected during the campaign and potential science topics of interest that can be investigated using them.

Agenda:

- 1:30-2:00 Overview of CACTI Measurements and Science – Adam Varble
- 2:00-2:10 *Question and Answer Period*
- 2:10-2:25 Radar Datasets Overview – Joseph Hardin

2019 ARM/ASR Meeting: Breakout, Working Group, and Tutorial Session Agendas

2:25-2:30	<i>Question and Answer Period</i>
2:30-2:45	G-1 Aircraft Datasets Overview – Alyssa Matthews
2:45-2:50	<i>Question and Answer Period</i>
2:50-3:05	Overview of RELAMPAGO Measurements and Science – Stephen Nesbitt
3:05-3:10	<i>Question and Answer Period</i>
3:10-3:20	Updates on Data Product Stages and Plans - TBD
3:20-3:30	<i>Question and Answer Period</i>

Lidar Applications

Conveners: [Rob Newsom](#), [Larry Berg](#), [Dave Turner](#)

Description: The ARM lidar systems are powerful tools for understanding a wide variety of atmospheric processes that are being used in a number of science projects. The goal of this session is to provide an opportunity for scientists to describe how lidar data are being used in their research, and to highlight the issues and challenges associated with the use of these data. The intent is to provide a forum for data users to share results, lessons learned, and provide feedback to the ARM User Facility. The focus in this session is on the science applications of the Doppler, Raman and High Spectral Resolution lidar systems deployed at either the ARM fixed sites or with the AMFs.

Agenda:

- Rob Newsom: Introduction
- Larry Berg: Using Doppler lidar to evaluate simulations of the evening transition.
- Rob Newsom: New developments in water vapor profiling: the Vaisala broadband DIAL
- Dave Turner: New developments in water vapor and temperature profiling: the MSU/NCAR Micropulse DIAL
- Dave Turner: Water vapor similarity
- Ray Bambha: Planned upgrades for the ARM HSRLs
- Duli Chand: Calibration stability of the ENA Raman lidar
- Satoshi Endo: Reconciling differences between LES-predicted and Doppler Lidar observed cloud base vertical velocities.
- Neil Lareau: Lidar Observations of Updrafts and Water Vapor Anomalies at ARM SGP
- Kyle Dawson: Lidar-Retrieved Aerosol Humidification Factors

Secondary Organic Aerosol

Conveners: John Shilling, Rahul Zaveri, Manish Shrivastava, Alla Zelenyuk, Joel Thornton

Description: The guiding philosophy for cooperative science in the secondary organic aerosol (SOA) group, both for incorporating knowledge into models and identifying new and important emerging topics for study, is to focus on SOA formation and aging processes that are missing in aerosol climate models and have large potential implications on clouds and radiative forcing. The goals of the session are: to share and discuss the latest results from ASR/ARM funded SOA research including; laboratory, field, and modeling efforts and to plan for future collaborative efforts and emphases.

Participants: We encourage submissions of 2-3 slides for 5-10 minute presentations (including discussion).

Monday, June 10, 4:00 pm – 6:00 pm, Breakout Session 2

ARM Aerosol Measurements Supporting ASR Science

Conveners: Jim Smith, Jim Mather, Nicole Riemer, Allison McComiskey

Description: ARM operates ground-based Aerosol Observing Systems (AOS) at five of its six ground-based observatories. Each of these AOS provides measurements of aerosol number and size distributions, optical properties, propensity to nucleate cloud droplets, and broad chemical categorization. There seems to be an underutilization of these measurements. This underutilization could stem from a variety of factors including a mis-match in measurements with measurement needs, data quality or continuity, appropriate data products, or data product complexity. There is a strong interest on the part of both ARM and ASR to provide data products that meet DOE science goals. Over the past several years, there have been a series of meetings and assessments (including a breakout at the 2018 ARM/ASR PI meeting) designed to improve this match between provided data products and science needs. This breakout we will provide updates and seek community feedback on ARM's ongoing efforts to align facility observations of aerosols and atmospheric trace gases with the needs of the research community. Topics to discuss include:

- Summary of progress toward the aerosol measurements implementation plan
- Review of the current status of aerosol measurements
- Review of a recent survey of ARM aerosol measurement usage and needs
- Plans to refine the aerosol measurement strategy
- Summary of recent efforts to establish best practices for instrument operation and calibration

Agenda:

4:00 – 4:10	Introduction
4:10 – 4:50	Summary of progress toward the aerosol measurements implementation plan Review of the current status of aerosol measurements
4:50 – 5:10	Summary of recent efforts to establish best practices for instrument operation and calibration
5:10 – 5:30	Review of a recent survey of ARM aerosol measurement usage and needs
5:30 – 6:00	Discussion on ARM aerosol measurement strategy

Process driven sampling strategies for ARM instruments

Conveners: Scott Collis, Marcus van Lier-Walqui, Brenda Dolan, Andrei Lindenmaier

Description: In the last ten years ARM has invested in increasingly complicated instrumentation. These instruments (Primarily Radar and Lidar) are highly configurable. This allows the operation of the instrument to be tailored to observe specific atmospheric processes. The Southern Great Plains X-Band scanning experiment, carried out in the Summer of 2018, set up a rotating schedule that alternated the operations of the X-Band network between a mode targeting dynamics and microphysics of storms (Multi-Doppler mode) and a mode that looked at fast evolution of microphysics just above the freezing level (microphysics mode). Instead of trying to observe the totality of the physics of interest to ARM stakeholders these modes are tailored to address specific science questions.

This session, which will be a mix of talks and a panel, will use the experiment to drive conversation on the benefits and costs associated with specialized operations of ARM infrastructure. The goal of this session is to deliver, through the session report:

- An overview of progress from the SGP experiment.
- A discussion on process-driven processing (certain parameters in processing VAPs are not applicable to all science questions) and targeted sampling. What are the benefits of this approach? What are the costs?
- Identification of where else (instruments, sites) targeted science-driven sampling would be worth pursuing. Is this the role for ARM or are targeted experiments better left to other agencies? What are the tradeoffs between trying to observe as many phenomena as possible versus targeting

specific phenomena.

- The relationship between process-driven sampling and data epochs.

Agenda:

(Each presentation will have 10 minutes for presenting and 5 minutes of discussion.)

- 16:00 Scott Collis: Framing and motivation for the session
- 16:15 Marcus van Lier-Walqui, Brenda Dolan, Andrei Lindenmaier And Sara E. Lytle: The Summer Sampling Experiment at the SGP.
- 16:30 Paytsar Muradyan: Adaptive Sampling Modes for Radar Wind Profilers.
- 16:45 Ann Fridlind: Advancing observational constraints on high-latitude cloud processes.
- 17:00 Stephen Nesbitt: Process- and hardware-driven scanning radar scanning in CACTI

17:15 -> 18:00 Panel session with presenters discussing the merits of homogeneous versus processed based sampling. Gathering input from attendees on what ARM should be doing next. Ideas of epochs.

Interactions among the land surface, convective boundary layer, clouds, and aerosols

Conveners: Yunyan Zhang, Larry Berg

Description: This breakout session will focus on:

- 1) better understanding the impact of land surface on boundary-layer turbulence and cloud dynamics, microphysics and morphology using ARM data and fine-scale models such as LES; and
- 2) diagnosing biases and improving representation of the interaction and feedbacks between land surface, convective boundary layer, clouds and aerosols in regional or large-scale models.

This breakout will highlight process studies of local and diurnal scales and include:

- 1) updates on ARM land surface measurements;
- 2) updates on ARM boundary layer profiling data development;
- 3) results from recent field campaign such as HI-SCALE, LAPE, Go-Amazon, and CACTI; and
- 4) results from long-term SGP data analysis, LES studies, and regional and climate model simulations

Agenda:

Updates From Field Campaigns and New Observations

(40 min)

- Updates from CACTI
- Lidar update
- Updates from HI-SCALE
- Analysis of the shallow-to-deep convection transition in GoAmazon observations

Adam Varble
Rob Newsom
Jerome Fast

Yang Tian

ARM Data and Model Evaluation

(60 min)

- Investigating the mechanisms of shallow precipitating clouds formation during HI-SCALE
- Land-atmosphere coupling strength for locally generated convective regimes at the ARM SGP site
- Irrigation helps alleviate climate model warm-and-dry bias over the central US
- Understanding the difference in ECOR and EBBR turbulent fluxes at SGP and its impact on forcing and SCM simulations
- Characterizing vegetation spatial heterogeneity for cloud-resolving hindcasts in the SGP
- Surface observational data requirement from high-resolution modeling perspective

Jingyi Chen
Cheng Tao
Yun Qian
Shuaiqi Tang
Ian Williams
Qi Tang

Discussion

(20 min)

Discussion topics include:

- What data do we need to evaluate or constrain LACI processes in models?
- In what ways can we increase collaboration?

Applications of machine learning to ARM/ASR science

Conveners: Joe Hardin, Rao Kotamarthi, Jennifer Comstock, Shaocheng Xie, Ed Luke

Description: Machine learning (ML) has seen an explosion of interest in many fields including atmospheric science, providing a tool capable of solving previously intractable problems. ARM has recently funded several machine learning based projects, and researchers throughout ASR have started applying machine learning methods to their research.

This session has the following discussion points:

- Updates from ARM/ASR funded machine learning projects
- Presentation of novel applications of machine learning to ARM data
- Discussion of ML techniques for learning from modelling and observational datasets to improve model parameterizations.
- Addressing ways in which ARM and ASR can improve their accessibility to ML solutions.
- Discussion of techniques from the field that could help ARM/ASR address uncertainty quantification.
- Are there any immediate needs the ARM/ASR community has that could benefit from machine learning?
- Is there anything we as a community could better do to reach out to the broader ML community?

Agenda:

4:00-4:20	Joseph Hardin	Introduction & Overview of ARM ML Resources and plans
4:20-4:30	Jiali Wang	Fast domain aware neural network emulation of a planetary boundary layer parameterization in a numerical weather forecast model
4:30-4:40	Yangang Liu	Machine Learning for Cloud Microphysics Parameterization
4:40-4:50	Shuaiqi Tang	A Machine Learning Framework for ARM Data Quality Analysis: MWR Rain Contamination Detection
4:50-5:00	Ed Luke	Scanning radar sea-clutter mitigation using deep neural networks
5:00-5:10	Vanessa Przybylo	Ice Particle and Aggregate Simulator
5:10-5:20	Jitendra Kumar	Deep Convolutional Neural Networks for Hydrometeor Classification Using Dual Polarization Doppler Radars
5:20-5:30	V. Chandrasekar	AI and machine learning with weather radars
5:30-6:00		Discussion and Wrap-up

Tuesday, June 11, 12:30 pm – 1:30 pm – Working Lunch

ARM User Executive Committee (UEC) Networking Lunch

Conveners: Sebastien Biraud and Allison Aiken

Description: The ARM User Executive Committee (UEC) will host an ARM “Newcomers Networking Lunch”. We invite all individuals new to the ARM program to share a meal with the UEC and other members of the ARM Infrastructure. At this lunch, you will have the opportunity to meet the UEC, other newcomers, and learn more about the ARM Facility.

Participants: Please note that **RSVP is requested** so we can plan for logistics. Indicate your plan to attend to Sebastien Biraud (scbiraud@lbl.gov) and Allison Aiken (aikenac@lanl.gov).

Tuesday, June 11, 1:30 pm – 3:30 pm, Breakout Session 3

LASSO Update and Discussion: Expansion beyond Shallow Convection

Conveners: Bill Gustafson, Andrew Vogelmann, James Mather

Description: The objectives of this breakout session are to:

- Communicate LASSO cases released during the past year and the current state of LASSO
- Communicate information from the LASSO Expansion Workshop
- Provide a forum for the community to provide input on LASSO expansion scenarios

The Large-Eddy Simulation (LES) Atmospheric Radiation Measurement (ARM) Symbiotic Simulation and Observation (LASSO) workflow provides high-resolution simulations of shallow convection at ARM’s Southern Great Plains (SGP) atmospheric observatory to complement the large suite of observations at the site. The goals of this breakout session are to convey an update of LASSO releases since the prior PI Meeting and to involve the ARM/ASR community in the decision process for LASSO expansion.

Since the previous PI Meeting, LASSO has released 30 case dates from 2017 plus 30 case dates are scheduled for release from 2018 prior to the 2019 PI Meeting.

Agenda:

1:30 p.m. Annual update on LASSO status and new simulations

1:50 p.m. Planning for expanding LASSO beyond shallow convection at SGP

NOTE: This is the last public forum for providing feedback on the LASSO expansion prior to submitting the associated report to ARM management.

- 1) Report on the *LASSO Expansion Workshop* held 2 May 2019
- 2) Discussion of proposed expansion scenarios: Arctic Clouds, Clear-Air Turbulence, Deep Convection, and Maritime Clouds

Update on ARM Shortwave Spectral Radiometer Strategy

Conveners: Laura Riihimaki (laura.riihimaki@noaa.gov), Allison McComiskey (amccomiskey@bnl.gov), and Connor Flynn (connor.flynn@pnnl.gov)

Description: Several recent developments are opening the door to new use of SW spectral measurements for retrievals and radiative studies. These developments include improvements in measurement technologies (including commercially available hyper-spectral instruments), new retrieval methodologies which are not strongly dependent on absolute calibration accuracies, and the potential of spectral radiation for ARM's new focus on distributed measurements integrated with high-resolution modeling. This session will describe the results of a meeting in February 2019 reviewing the potential of ARM's SW spectral radiometer measurements for process studies and radiation budget studies in complex environments. The session will include science talks introducing new uses of SW spectral radiometers and discussion of meeting outcomes (e.g. collaborative case studies to test new retrieval/measurements, publication on emerging uses of SW spectral measurements, and measurement priorities).

Agenda:

1. Review of workshop motivation and summary of science outcomes (30 min)
2. Talks highlighting innovative use of SW spectral measurements (40 min)
 - Christine Chiu—*Using spectral radiance observations to constrain cloud-drizzle-aerosol processes*
 - Dan Lubin—*Cloud optical properties over west Antarctica from shortwave spectroradiometer measurements during AWARE*
 - Jake Gristey—*Surface solar irradiance variability under shallow cumulus clouds at SGP: Insights from observations and LES*
 - Sasha Marshak—*ARM shortwave spectrometers to study the clear-cloud transition zone and mixing processes*
3. Discussion (50 min)
 - Science goals and instrument needs
 - Case studies—Planning for retrieval development and comparison at LASIC, TCAP, and ACE-ENA
 - Presentation of BAMS article plans & formation of a group for future meeting

Aerosol and Cloud Experiments in the Eastern North Atlantic (ACE-ENA)

Conveners: Jian Wang, Jason Tomlinson, Beat Schmid

Description: The main focus of the breakout session is to bring together members of the ASR Science Team, ARM Aerial Facility, ARM infrastructure, and other colleagues to discuss measurements collected during the ACE-ENA campaign, progress towards quality controlled datastreams and value-added products, preliminary scientific results, and ongoing research activities. Discussions will be aimed at identifying collaborative research opportunities, and identifying unaddressed research avenues.

The session agenda includes (1) presentation of an overview of scientific objectives and conditions sampled during ACE-ENA intensive operation periods, (2) presentation and discussion of data availability and quality, (3) presentation of early results and ongoing research, (4) discussion on what science questions can be addressed most effectively using the data available, (5) report on the progress of an overview manuscript, and (5) discussion on the development of cases for model simulations/validation.

Ice nucleation

Conveners: Xiaohong Liu, Paul DeMott, Daniel Knopf, Nicole Riemer

Description: The objective of this breakout session is to (1) review progress on ice nucleation from ARM/ASR funded observations to modeling studies, and to (2) identify and discuss existing and potential avenues for the use of ARM/ASR data sets or future field campaigns to advance understanding and constraints on model prediction of ice nucleation. This breakout session will be organized into two portions. In the first portion, we invite short contributions to report on how existing and potential future ARM/ASR measurements can be used to make specific advances in understanding and modeling ice nucleation. The existing campaigns activities include AWARE, MARCUS, MICRE, etc. The proposed AIC (Aerosol-Ice Formation Closure)-pilot study will be described during this section. The second portion of the breakout will be used for discussions on main issues/remaining questions/new ideas to motivate future campaigns/group activities such as: (1) What is the contribution of supermicron sized particles to ambient INPs? (2) What is the role/importance of deposition ice nucleation to total INPs? (3) Where and under what conditions is ice multiplication occurring?

Agenda:

- 1:30 Introduction
- 1:35 **Daniel Knopf** (Stony Brook University) – The ARM SGP Aerosol-Ice Formation Closure Study
- 1:40 **Naruki Hiranuma** (West Texas A&M Univ.) – Future Implications of Aerosol Physicochemical Properties Including Ice Nucleation at ARM Mega Sites for Improved Understanding of Microphysical Atmospheric Cloud Processes
- 1:45 **Gourihar Kulkarni** (PNNL) – Time dependence of proxy and ambient INPs towards ice nucleation activity - Preliminary results
- 1:50 **Swarup China** (PNNL) – Ice nucleation activity of glassy soil organic particles under cirrus conditions
- 1:55 **Will Cantrell** (Michigan Tech) – Aerosol mediated glaciation and persistence of mixed-phase clouds: Steady-state laboratory experiments
- 2:00 **Susannah Burrows** (PNNL) –
- 2:05 **Nicholas Kedzuef** (Colorado State Univ.) – Ice number concentration retrievals from scanning cloud radar measurements for studying secondary ice production
- 2:10 **Xi Zhao/Xiaohong Liu** (University of Wyoming) – Global relevance of secondary ice production: Influences on cloud properties and radiative forcing
- 2:15 Discussion –
 - Topic 1: What is the contribution of supermicron sized particles to ambient INPs?
 - Topic 2: What is the role/importance of deposition ice nucleation to total INPs?
 - Topic 3: Where and under what condition?

Wednesday, June 12, 10:30 am – 12:30 pm, Breakout Session 4

ARM West Antarctic Radiation Experiment (AWARE)

Conveners: Dan Lubin, Andrew Vogelmann, Johannes Verlinde

Description: The AWARE breakout session will address how Antarctic atmospheric science fits into the larger picture of understanding global change and improving climate model simulations. This year's AWARE session will have a greater emphasis on climate model applications, in addition to covering what the AWARE AMF-2 and WAIS Divide campaigns specifically accomplished. Substantial discussion time will be reserved to also address current issues and future directions in Antarctic science and the unique

challenges of atmospheric science over the Antarctic continent. We will also review significant contrasts with the Arctic in cloud and aerosol microphysics. This session therefore solicits presentations from both modelers and observationalists, from all disciplines within ASR including radiation measurement, physical meteorology and aerosol science. The three general objectives are (1) to review how AWARE data are providing case studies and other input to current model development and validation, (2) to plan new and continuing modeling applications, and (3) to begin strategizing about future collaborative ARM/ASR efforts in Antarctica.

Agenda:

- 10:30 Dan Lubin (Scripps Institution of Oceanography) – Introduction
- 10:40 Keith Hines (Byrd Polar and Climate Research Center) - Microphysics of Summer Clouds in Central West Antarctica Simulated by Polar WRF and AMPS
- 10:50 Wuyin Lin (BNL) - WAIS warming event simulated with GISS ModelE and E3SM
- 11:00 Xiaohong Liu (University of Wyoming) - Evaluating the impact of simulated mixed-phase clouds on the Antarctic energy budget during the AWARE field campaign
- 11:10 Israel Silber (Penn State) - Cloud and water vapor influences on ERA5, AMPS, and ModelE3 surface downwelling longwave radiation biases in West Antarctica
- 11:20 Fan Yang (BNL) - Effects of boundary decoupling layer on the change of phase partitioning in the mixed-phase stratiform clouds
- 11:30 Damao Zhang (BNL) - Polar aerosol profile comparisons using AWARE lidar measurements
- 11:40 Alessandro Battaglia (University of Leicester) - Triple frequency radar characterization of cloud microphysics at McMurdo during AWARE
- 11:50 Discussion – Topic 1: Future ARM science and fieldwork in Antarctica. Topic 2: From model evaluation to microphysical parameterization improvements using AWARE data.

TRacking Aerosol Convection interactions ExpeRiment (TRACER)

Conveners: Mike Jensen, Nitin Bharadwaj

Description: To increase our understanding of convective processes and convection-aerosol interactions, the recently selected ARM campaign, TRacking Aerosol Convection Interactions ExpeRiment (TRACER), will take place in the greater Houston metropolitan area from April 2021 through April 2022, with an intensive observational period from June through September of 2021. TRACER will involve the deployment of the 1st ARM Mobile Facility, the 2nd-generation C-band Scanning ARM Precipitation Radar (CSAPR2), and an ancillary site with additional aerosol and atmospheric state measurements. The session will provide an introduction of the TRACER science goals and deployment strategies to the larger ARM/ASR community. Initial planning activities will be discussed including; siting and instrumentation decisions, adaptive radar scanning considerations and evolving interagency and international synergies.

Agenda:

- Mike Jensen – An overview of the TRacking Aerosol Convection interactions ExpeRiment (TRACER) – Motivation and Campaign Plans
- Pavlos Kollias – Update on NSF Facility Request and Science Support for the High Definition Convective Clouds Evolution Experiment (HDC2EX)
- Nitin Bharwadaj – Discussion: ARM Radar Scanning and Cell Tracking
- Mike Jensen – Discussion: Identifying and Filling Additional Measurement Needs for TRACER Science

Marine cloud-topped boundary layer processes: cloud, aerosol, drizzle and turbulence

Conveners: Xue Zheng, Robert Wood

Description: The session will focus on cloud-aerosol-drizzle-turbulence interactions in the marine cloud-topped boundary layer. These interactions are important for determining cloud responses to greenhouse gases and aerosols, and their representation in large-scale numerical models continues to be a major challenge. The goal of the proposed session is to provide participants of ARM/ASR funded MBL projects with an opportunity to show and discuss their latest observational analyses, model simulations or assessments, and data products. Topics of relevance include: 1) case studies from recent intensive observing periods (e.g. MAGIC, LASIC, ACE-ENA, MARCUS/MICRE); 2) observational data analyses spanning multiple field campaigns or ARM sites; 3) advanced observing techniques and retrievals; 4) MBL cloud, aerosols and their interactions in numerical models; and 5) any other interesting MBL processes.

Agenda:

OBSERVATIONAL ANALYSES [10:30-11:25]

1. A Three-Year Study of the Summertime Thermodynamic, Cloud, Sub-Cloud Turbulent Kinetic Energy, and Sub-Cloud Mixing Length from ENA Site - Mark Miller [Rutgers University]
2. The Vertical Structure of Liquid Water Content in Shallow Clouds as Observed by Dual-Wavelength Radar - Zeen Zhu [SUNY]
3. Observational Evidence of the Effect of Large-Scale Drivers on Marine Boundary Layer Precipitation During Subsidence in the Eastern North Atlantic - Katia Lamer [CUNY]
4. Episodes of Warm-Air Advection Causing Cloud-Surface Decoupling During MARCUS - Youtong Zheng [University of Maryland]

MODEL REPRESENTATION AND EVALUATION [11:25-12:05]

5. Sensitivity of Marine Clouds Formed Through Shallow Convection to Changes in Atmospheric Circulation and Model Physics - James Booth [CUNY]
6. Assessment of Precipitating Marine Stratocumulus in E3SMv1: A Case Study During the ARM MAGIC Campaign - Xue Zheng [LLNL]
7. An Evaluation of Size-resolved Cloud Microphysics Scheme Numerics for Use with Radar Observations - Hyunho Lee [GISS]

GENERAL DISCUSSION [12:05-12:30]

Brown carbon and aerosol light absorption uncertainty: bridging the observation-to-modeling gap

Conveners: Yan Feng, Art Sedlacek

Description: The goal of this session is to develop a roadmap toward improved constraints on aerosol light absorption from observations and modeling. We will first review recent progress in laboratory and field observations regarding the fundamental chemical, microphysical, hygroscopic, and optical properties of the light-absorbing aerosols. Specifically, we will focus on: dynamic absorption of BrC and alteration of BC absorption due to coating and aging. There will be targeted presentations on results from recent ARM-sponsored and other field campaigns and laboratory experiments, as well as modeling talks about BrC and absorbing aerosols at different scales. In the end, we will define several immediate goals and steps toward constraining the aerosol absorption by developing a consistent terminology for BrC between observational and modeling communities, improving the treatment of fresh vs aged BC and BrC optical properties, and identifying potential closure studies using airborne in situ vs column measurements.

Agenda:

10:30-11:40 am: short talks help to set the stage:

- 10:30 "Composition and Chemical Identity of BrC" (Alex Laskin)
- 10:40 "Mie Analysis of BB Aerosol Optical Observations and Towards Measurements of RH effect on Absorption" (Manvendra Dubey)
- 10:50 "Tar balls: An Important Class of BrC" (A. Sedlacek)
- 11:00 "Characterizing Biomass Burning Plumes in the Western US: Mount Bachelor Observatory Measurements" (J. Laing/A. Sedlacek)
- 11:05 "Atmospheric processing of wildfire plumes – aging of BBOA and change of aerosol light absorption" (Qi Zhang)
- 11:15 "Temporal and special variability and properties of BB aerosols sampled during HI-SCALE" (Alla Zelenyuk-Imre)
- 11:25 "Long-range transported North American wildfire aerosols observed in marine boundary layer of eastern North Atlantic" (Jian Wang)
- 11:35 "Challenges in modeling BrC and aerosol absorption" (Y. Feng)

11:40 am-12:30 pm Discussion:

- i. Where do we stand now in laboratory studies and field observations?
- ii. What are the major gaps between observed and modeled aerosol absorption?

Wednesday, June 12, 12:30 pm – 1:30 pm, Working Lunch & Tutorials

Social media for communicating research

Convener: Hanna Goss

Description: A lunch-time tutorial related to using social media and blogging for communicating research. Presenters will include Jerome Fast discussing his experience blogging for HI-SCALE and Matt Shupe regarding his plans for MOSAiC.

Data Discovery and Access: Current, New and Upcoming Capabilities

Convener: Giri Prakash

Description: In support of ever-increasing new field-campaigns and high-resolution modeling activities, the ARM Data Center is continually improving data discovery, delivery and computing capabilities. This lunch time tutorial will be a hands-on session consists of two parts. In the first part of the tutorial, we will discuss recently enabled data discovery functionalities, data access, data extraction, delivery options, automated data and quality access via web services, and big data analysis platform for identifying data of interest. The ARM data discovery interface is currently undergoing a major design revision with a goal to improve the user experience. In the second part of the tutorial, we will demo the newly built data discovery design and gather feedback from the participants. We will also briefly cover ADC's two high performance computing clusters which allow scientists to access and conduct research using any archived ARM data. Members from various ARM Data Service teams will be available to answer any questions related to finding and accessing the ARM data.

Wednesday, June 12, 1:30 pm – 3:30 pm, Breakout Session 5

Upcoming Arctic campaigns (MOSAiC, COMBLE)

Conveners: Bart Geerts, Matt Shupe, Mikhail Ovchinnikov

Description: Description The Arctic system is in a state of rapid change with important implications for the regional and global climate system. ARM is well positioned to provide major insight into this changing system through a pair of upcoming field campaigns: The Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition will take place from September 2019 to October 2020 within the Central Arctic ice pack and the Cold-Air Outbreaks in the Marine Boundary Layer (COMBLE) experiment will take place from January to May 2020 on the northern Norway coast and on Bear Island in the Norwegian Sea. These experiments represent some of the most sophisticated suites of instruments to ever be deployed in the Arctic and, based on their regional placement, are well designed to observe cloud and atmosphere processes related to large-scale flow both into, and out of, the Arctic. While each experiment is designed to address a targeted set of science questions, their regional and temporal proximity offers the unique ability to also leverage these experiments towards addressing numerous broader topics. This session will cover both experiments and recent relevant research that can impact, and be supported by, these new efforts. Overview presentations will be provided for both campaigns, followed by focused presentations on campaign preparation studies and activities. The session is open to contributed presentations on recent relevant Arctic research from both observational and modeling perspectives. Lastly, a discussion will focus on leveraging these projects towards achieving broader science objectives.

Agenda:

- 1) AMF1/AMF2 status for COMBLE and MOSAiC - Heath Powers or delegate
- 2) MOSAiC Science Status - Matthew Shupe
- 3) COMBLE Science Status - Bart Geerts
- 4) Climatology of wintertime Arctic cold-air outbreaks derived from ERA5 reanalysis data and AROME-Arctic weather model - Yonggang Wang
- 5) Brief overview of Arctic-scenario for LASSO (i.e., MOSAiC focus option) - Matthew Shupe (or Gijs de Boer)
- 6) Open discussion on leveraging Arctic activities.

Evaluation of Measurement Needs to Address Cloud and Precipitation Science Issues

Convener: Jim Mather

Description: ARM is continuously evaluating how to increase the impact its measurements are having on advancing atmospheric science. The purpose of this session is to identify operational or development needs to address outstanding science questions related to clouds and precipitation. This session will include a review of the status of cloud and precipitation measurements as well as discussion of science topics in which ARM has the potential to support significant advancements in the next ~5 years.

Demonstration of a New Visual Tool to Quickly Combine ARM datasets

Conveners: Krista Gaustad and Carina Lansing

Description: Do you want to spend less time preparing data for your analysis and more time doing the analysis? Come to our session to see how the new ARM data consolidation wizard can help you take inputs from different continuous ARM time centric datasets and combine them to produce a single output product with just the measurements you need and on a time scale of your choosing. The wizard walks users through selecting the input data sources to be consolidated and creating an output product for a specific location and time range. The user can save this information in the wizard to access it in the future to run against different locations and time periods.

Agenda:

(Audience members are encouraged to bring a computer and participate)

- Background (1:30 to 1:45)
Provide a high-level overview of a new web-based application for consolidating data from multiple ARM datastreams into a single analytical data product.
- Group Data Consolidation Exercise (1:45 to 2:05)
Demonstrate the use of simple examples representing a typical use case.
- Evaluating Results (2:05 to 2:30)
Evaluate the results and output through plots and logs.
- Advanced Features (2:30 to 3:20)
Demonstrate complex example to illustrate advanced features such as consolidation of multi-dimensional data, transformation controls, and representation of data quality. Examples of how to identify preferred data sources using the ARM data catalog's search, data filtering, and dependency diagram features will be covered.
- Getting LDAP account Access (3:20 to 3:30)
We will review the requirements for getting regular access to the data consolidator web tool.

Shortwave-absorbing aerosols and their interactions with clouds

Conveners: Paquita Zuidema, Art Sedlacek, Allison Aiken

Description: Biomass-burning aerosols represent complex mixtures of black carbon and organic aerosols that also contain brown carbon. The aerosol chemical compositions and black carbon properties will change with age, affecting the aerosol's optical and cloud-nucleating properties in time-dependent ways. These affect the direct aerosol radiative effect, which also depends on the underlying albedo, either of the earth's surface or clouds. Clouds, if present, in turn adjust to the presence of smoke. Clouds can adjust both semi-directly to the absorbed sunlight, or indirectly through changes to their microphysics when clouds and aerosols mix. The dominant processes will vary with the aerosol-cloud vertical structure, which can vary seasonally, while the dominant cloud adjustments will also evolve as the clouds advect. Modeling efforts are necessary to help articulate the significant processes, with model-observational closure/validation studies promoting confidence in model-based analyses. The characterization of truly aged biomass-burning aerosol, its relationship to the prevalent marine cloud, and the processes by which the clouds interact with the smoke, motivated the LASIC (Layered Atlantic Smoke Interactions with Clouds) campaign held in the remote southeast Atlantic on Ascension Island, spanning June 1, 2016 - October 31, 2017. This session is intended to highlight work based on LASIC, but is not limited to just LASIC, as the motivating issues occur globally. Lab studies are also encouraged. We invite all attendees with relevant material. This session will be coordinated with a session focusing more on properties of brown carbon led by Yan Feng and Art Sedlacek.

Thursday, June 13, 10:30 am – 12:30 pm, Breakout Session 6

MICRE/MARCUS and Southern Ocean Activities

Convener: Roger Marchand

Description: This session will review status of MICRE/MARCUS datasets and provide opportunity for ARM PIs to present latest results of research related to the Southern Oceans.

How ARM Meets the Needs of ASR Science Goals (Panel Discussion)

Conveners: Shaocheng Xie, Jennifer Comstock, Jim Mather

Description: The goal of this panel discussion session is to facilitate two-way feedbacks between the ARM infrastructure team and ASR science team to improve the understanding of priorities on both ARM data developments and ASR working group research activities and address the critical ARM data needs of the ASR working groups. The panel discussion will include a few short 5-minute talks to highlight major ASR working group activities and their urgent data needs, as well as major ARM data developments and their potential use in support of ASR science. The majority of time will be dedicated to panel discussion. The panel members will consist of representatives from both ARM and ASR.

Open Science for Advancing Knowledge Transfer across CESD

Conveners: Scott Collis, Giri Prakash, Mariko Oue, William Gustafson, Joseph Hardin

Description: ARM and ASR have a diverse pool of stakeholders, PIs, and scientists working in the service of science. Each day these scientists carry out a largely common set of tasks. For example; looking at data quality, making plots, performing retrievals, running simulations and making inferences. Occasionally an essential idea for one group is sitting within unreleased code at another institution. A key way of facilitating knowledge transfer is through Open Science which can be broken down into six components: Open source code, open data, open educational resources, open access, open methodology and open peer review. This session will focus on the first three. The main goals of the session are:

- Answering the question “What is open science?”
- Capturing the state of open source projects and open science efforts across CESD. Give scientists working on tools the opportunity to inform attendees as to the tool’s availability.
- Highlighting ARM and ASR efforts in open data.
- Identifying key areas for future development across science and infrastructure.
- Soliciting audience feedback on activities which could accelerate science in CESD through workshops, short courses (eg AGU/AMS) and new capabilities in ARM.

This session will be half presentation based and half open discussion with the deliverable being a session report capturing the state of open science in CESD and suggestions for future directions.

Agenda:

Each presentation will have 10 minutes for presenting and 5 minutes of discussion.

10:30 Scott Collis: What is open science? Framing discussions and some of our experiences.

10:45 Mariko Oue: Open Sourcing Radar Simulators: Efforts and Challenges.

11:00 Adam Theisen: Atmospheric data Community Toolkit (ACT): An Open-Source Library for Connecting Users to Data.

11:15 Joseph Hardin: PyDSD, PARSQUANTS, and experience transitioning open source code into an ARM VAP.

11:30 William Gustafson: Thinking About LASSO and Open Sourcing

11:45 Peter Marinescu: TOBAC: A New Framework for Tracking Clouds in Different Datasets

12:00 to 12:30 Panel discussion with presenters on the place for Open Science within CESD and how we can be lowering barriers to entry.

Phase State of Organic Aerosol and Its Impact on Gas-Particle Interactions and Cloud Formation

Conveners: Manabu Shiraiwa and Daniel Knopf

Description: The particle phase state of organic aerosol (OA) including secondary organic aerosol (SOA) can vary among liquid, amorphous semisolid and glassy solid states depending on chemical composition, water content, relative humidity and temperature. The occurrence of glassy and amorphous (semi-)solid states can pose kinetic limitations to mass transport, affecting various gas-particle interactions including chemical transformation, SOA formation and partitioning, hygroscopic growth, and CCN and IN activation. It challenges the treatment of SOA processes in aerosol models. There is still a lack of understanding of the role and impact of phase state on gas-particle interactions and cloud formation. The goals of this breakout session are to identify gaps in our understanding of the role of particle phase state and to continue to foster collaborative research within the DOE ASR/ARM community (and beyond). Targeted presentation topics include laboratory experiments, field measurements and modeling of SOA phase state, effects of phase state on SOA processes and interactions with water (e.g., CCN, IN), and how to incorporate SOA phase state and its effect in regional and global modeling. The planned agenda includes short presentations with time for questions and discussions.

Agenda:

- Manabu Shiraiwa: "Impacts of phase state on gas-particle interactions"
- Daniel Knopf: "The role of the phase state of organic aerosol in cold cloud formation"
- Yue Zhang: "Examining the Effects of Aerosol Phase State on Aerosol Processes and Cloud Interactions: from Laboratory Studies to Modeling and Field Measurements."
- Gourihar Kulkarni: "Implications of phase state towards ice nucleation at cirrus temperatures"
- Markus Petters: "How well do we understand the phase state of secondary organic aerosols?"
- Manish Shrivastava: "Synergistic interactions between PAHs and SOA particles"
- Alla Zelenyuk: "The effect of the SOA phase on particle morphology and on reactive and non-reactive mass transfer processes"
- Rahul Zaveri: "Growth kinetics of secondary organic aerosol as a function of relative humidity"
- Joel Thornton: "Constraints on SOA viscosity from molecular composition observations during room temperature evaporation experiments"

Thursday, June 13, 1:30 pm – 4:00 pm, Working Group Sessions

Aerosol processes

Conveners: Nicole Riemer, Jim Smith

Description: The aerosol processes working group focuses on understanding of processes that control spatial and time-related distribution of aerosols and their chemical, microphysical (occurring on a microscopic scale), and optical properties. The goal is to reduce the uncertainty in radiative forcing (energy imbalance) due to these atmospheric particles. Research areas include: 1) new particle formation; 2) effects of aerosol composition, mixing state, and physical properties on growth, aging, and removal processes; 3) direct and indirect radiative effects of optically absorbing aerosols; and 4) understanding and predicting secondary organic aerosol concentrations and properties.

Agenda:

- 1:30 – 1:40 Welcome and introductory comments [Jim Smith and Nicole Riemer]
1:40 – 1:50 Aerosol Processes Working Group Translator comments [John Shilling]
1:50 – 3:30 Reports from the breakout groups [~10 min presentations from breakout group conveners]
- Secondary Organic Aerosol
 - Applications of machine and/or deep learning to ARM/ASR science
 - Aerosol and Cloud Experiments in the Eastern North Atlantic (ACE-ENA)
 - Ice nucleation
 - Brown carbon and aerosol light absorption uncertainty: bridging the observation-to-modeling gap
 - Shortwave-absorbing aerosols and their interactions with clouds
 - Phase State of Organic Aerosol and Its Impact on Gas-Particle Interactions and Cloud Formation
 - Interactions among the land surface, convective boundary layer, clouds and aerosols
 - TRacking Aerosol Convection interactions ExpeRiment (TRACER)
 - Marine cloud-topped boundary layer processes: cloud, aerosol, drizzle and turbulence
- 3:30 – 4:00 ARM Aerosol Measurements Supporting ASR Science

Convective processes

Conveners: Adam Varble and Mike Jensen

Description: The convective processes working group focuses on improving understanding and model representation of convective (heat-transferring) cloud processes and properties, including cloud cover, precipitation, life cycle, dynamics, and microphysics, over a range of spatial scales. Research areas include: 1) convective vertical velocity (upward heat transfer) and interactions with cloud microphysics and precipitation; 2) shallow to deep cloud transitions and organization of convective clouds on larger scales; and 3) interactions between cloud microphysics, aerosols, precipitation, and radiation.

Through group discussions focused on the aforementioned topics, we seek to:

1. Identify guiding science questions based on model inadequacies that will utilize ARM observations and support ASR programmatic objectives.
2. Facilitate and enhance efforts of individual ASR-funded projects through organization of smaller groups around focused research goals from which collaborations can be forged.
3. Identify and prioritize past, current, and future ARM field campaigns, measurement strategies, and data products that will most benefit group objectives.

Preliminary Agenda:

- Discuss working group description, objectives, mission, and research themes (5 min)
- Review relevant breakout sessions, recent/future field campaigns, and posters (25 min)
- DOE Lab SFA convective processes talks with discussion of potential for collaboration with non-DOE lab ASR PIs (30 min)
- Discussion of pre-meeting survey questions below (90 min):
 1. Does the research ongoing in ASR reflect overarching critical needs for improving understanding and model representation of deep convective processes? Do upcoming ARM field campaigns and IOPs? Why or why not?
 2. Can communication and collaboration between ASR projects, both lab and non-lab, be improved for mutual benefit, and if so, how? As an example, should we organize specific focus groups with dedicated breakouts and/or regular telecons?
 3. Which observations and products are most needed (currently existing or not) to make progress on improving understanding and model representation of deep convective processes? Are these adequately provided by ARM or another agency?
 4. Are existing ARM data and products easy to access and understand? Is ARM data quality and availability sufficient for your needs? Do you have any recommendations for improvement in these areas?

High-latitude processes

Conveners: Gijs de Boer and Greg McFarquhar

Description: The High Latitude Processes Working Group breakout session will offer an opportunity to discuss project progress and summarize discussions held on high-latitude-centric topics during the rest of the PI meeting. Additionally, time will be available to discuss issues related to recent, ongoing and upcoming deployments of ARM instrumentation to high latitude locations (e.g. MOSAiC, COMBLE, NSA, Oliktok Point, etc.), and the integration of such observations with ongoing community efforts (e.g. YOPP).

Agenda:

- 1:30-1:45: Welcome and Introductions
- Summary of High-Latitude relevant breakout sessions (5' for summary, 5' for discussion/questions)
 - 1:45-1:55: LASSO Update and Discussion: Expansion Beyond Shallow Convection [Andy Vogelmann]
 - 1:55-2:05: Ice nucleation [Paul DeMott]
 - 2:05-2:15: ARM West Antarctic Radiation Experiment (AWARE) [Dan Lubin]
 - 2:15-2:25: Upcoming Arctic campaigns [Bart Geerts]
 - 2:25-2:35: MICRE/MARCUS and Southern Ocean Activities [Roger Marchand]
- Science Presentations (10' for presentation, 5' for discussion):
 - 2:35-2:50: "Highly supercooled drizzle above Ross Island, Antarctica" [Israel Silber]
 - 2:50-3:05: "Arctic Hydrometeors and Boundary Layer Clouds" [Kyle Fitch]
- Data/VAPS :
 - 3:05-3:20: "High Latitude VAPS overview and Q+A" [Scott Giangrande]
 - 3:20-3:35: "Merged Observatory Data Files (MODFs) for Northern Alaska Sites" [Christopher Cox]
- 3:35-4:00: General Discussion
 - Group communications and results sharing
 - High Latitude Group needs
 - Upcoming campaigns/projects that the community should be aware of

Warm boundary layer processes

Conveners: Rob Wood and Yunyan Zhang

Description: Description The Warm Boundary Layer Processes (WBLP) working group focuses on understanding and model representation of processes controlling the structural and radiative properties of clouds, aerosols, and their interactions with the underlying surface in the lowest few kilometers of the atmosphere. Research areas include: 1) characterization of boundary layer and cloud dynamics; 2) cloud and aerosol microphysics and their interactions; 3) factors influencing cloud formation; and 4) radiative processes that together influence the vertical transfers of energy, moisture, and atmospheric components. This year's WBLP working group breakout session will be structured as follows:

- 1) Science talks highlighting recent field campaigns or new instrument techniques relevant for WBLP (LAFE; COGS stereo cloud project). [~1 hour]
- 2) Reports/highlights from WBLP-relevant breakout sessions [5 minutes each; 45 mins total]
- 3) Infrastructure update from lead translators [15 mins].
- 4) Open discussion on working group science activities and data concerns [30 mins]

Participants: Please contact session chairs Robert Wood (robwood2@uw.edu) and Yunyan Zhang (zhang25@lnl.gov) if you have questions or suggestions for discussion items.