

ARM Updates

ARM-ASR Joint User Facility PI Meeting

May 3, 2016

Sally McFarlane

Rick Petty

ARM Program Managers



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- Raymond McCord, ARM Data Archive Manager, is retiring from ORNL after over 20 years of managing the ARM archive
- Under Raymond's leadership, archive has grown from 200 GB in 1995 to over 800 TB in 2016
- Raymond was inaugural member of IMB and has been the face of ARM to numerous new users
- DOE acknowledges and thanks Raymond for his exceptional contributions to ARM

ARM Monograph

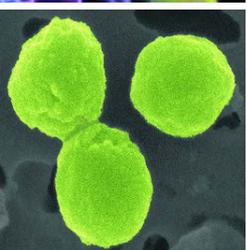
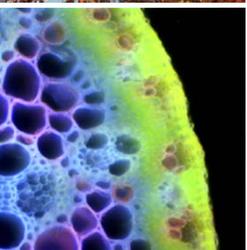
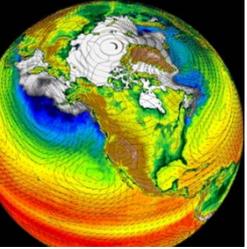
- AMS Monograph on the first 20 years of ARM
 - Dave Turner & Bob Ellingson, Lead Editors
 - Thanks to Nancy Burleigh for editing all of the chapters!
- 30 chapters written by former & current ARM scientists & engineers:
 - Four introductory chapters on origins & evolution of ARM
 - Eight chapters about ARM infrastructure, including sites, mobile facility, aircraft, and data
 - 18 technical chapters, including ARM contributions and impacts on understanding of water vapor; spectral & broadband radiometry; aerosol and cloud properties and their radiative impacts; cloud-resolving, single-column, and global climate modeling; and other topics
- Introduction online now; other chapters to be posted in next few weeks: <http://journals.ametsoc.org/toc/amsm/57>

Small Field Campaign Proposal Process

- Revised guidelines for small campaigns (campaigns with ARM costs < \$300,000)
- <http://www.arm.gov/campaigns/submit-proposals/small-campaigns>
- Established clearer review/decision timelines
 - Pre-proposals accepted year-round
 - IMB will do initial logistics review and set level of campaign within ~1 month
 - Level of campaign determines need for proposal, decision timeline (quarterly or semi-annually), and start time after decision
 - Extra time for unmanned aerial system campaigns due to FAA & OAM approval process; 180 days needed for Olightok access
 - Plan ahead for small campaigns!
- Clarified PI expectations
 - Data submission & final report within 6 months of campaign end

Large Campaign Proposals

- Requests for AMFs, AAF, MAOS, large campaigns at fixed site competed through annual call
- No call issued in 2016
 - Realign campaign timing to allow more time in between campaigns for instrument maintenance, etc.
- New call will be issued in ~December, 2016
 - Pre-applications will be due ~ Feb 1, 2017
 - Full proposals will be due ~ May 1, 2017
 - Science Board review in August, 2017
- <http://www.arm.gov/campaigns/submit-proposals>



Site Updates



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Legend

- Active Deployment
- Upcoming Deployment
- Previous Deployment
- Fixed Site
- ✈ Aerial Deployment



Southern Great Plains (SGP)

- **Field Campaigns:**

- Supporting 12 small IOPs
- Supporting ground-based observations for HI-SCALE

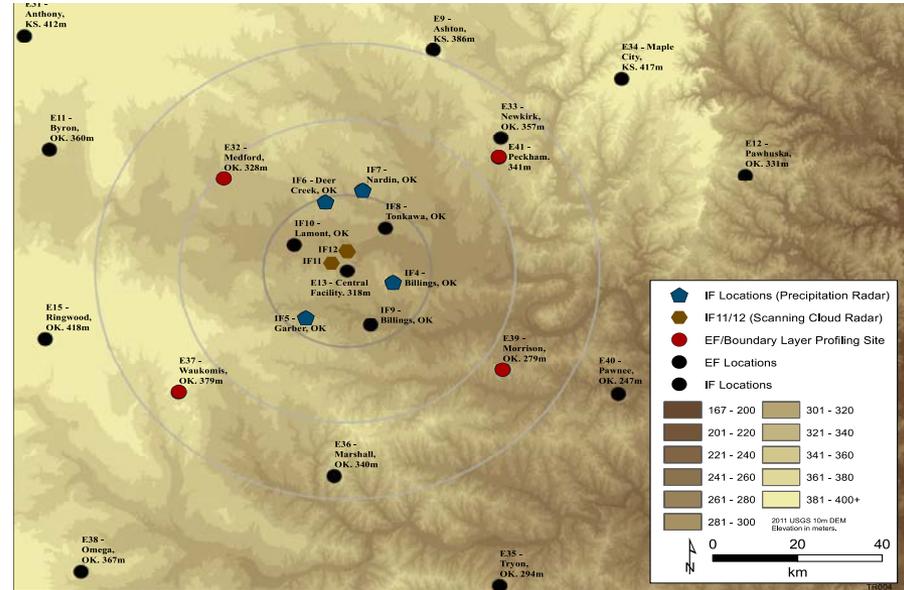
- **Instrumentation**

- Relocated the Raman Lidar closer to radar/lidars
- CSAPR2 testing
- Hosting AMF3 AOS for initial set-up, configuration, testing before transition to Oliktok
- New SGP AOS expected to be online Winter 2016



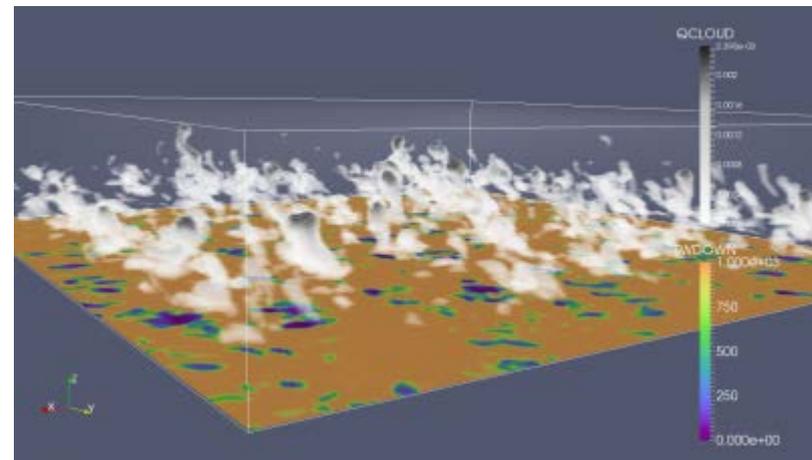
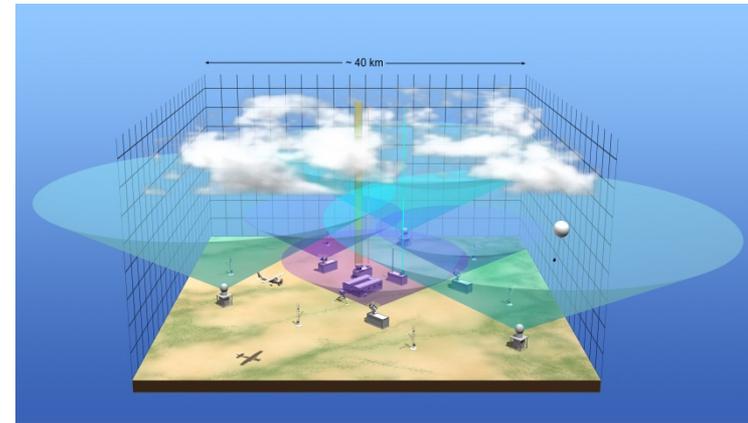
SGP Megasite

- Baseline set of ARM instrumentation at 3 new EF sites EF 39, 40, 41
- Installed new Soil Temperature And Moisture Profile (STAMP) systems at 17 EF sites 5 depths (2, 10, 20, 50, 100 cm)
- Installing 4 Profiling Modules (Microwave Radiometer 3 Channel, Atmospheric Emitted Radiance Interferometer, Doppler Lidar) at EF sites
- KaX SACR & KaW SACR Fall 2016



Routine LES modeling at SGP

- Large-Eddy Simulation (LES)
ARM Symbiotic Simulation and Observation (LASSO) project selected for Pilot study
 - PI Bill Gustafson, PNNL
 - Co-Is Andy Vogelmann, BNL & Zhijin Li, UCLA
- ARM Infrastructure developing data products & visualization tools
- Plenary talk today
- Breakout session Wed evening



Eastern North Atlantic (ENA)

IOPs:

Gamma Radiation - current
ACE-ENA – Summer 2017
ACTOS – Summer 2017



Instrument Additions:

Raman Lidar

CO₂/CH₄/H₂O Picarro

X-SAPR2

Short Wave Spectroradiometer (SWS)

Atmospheric Emitted Radiance

Interferometer (AERI)

Visit to ENA by Prime Minister of Portugal



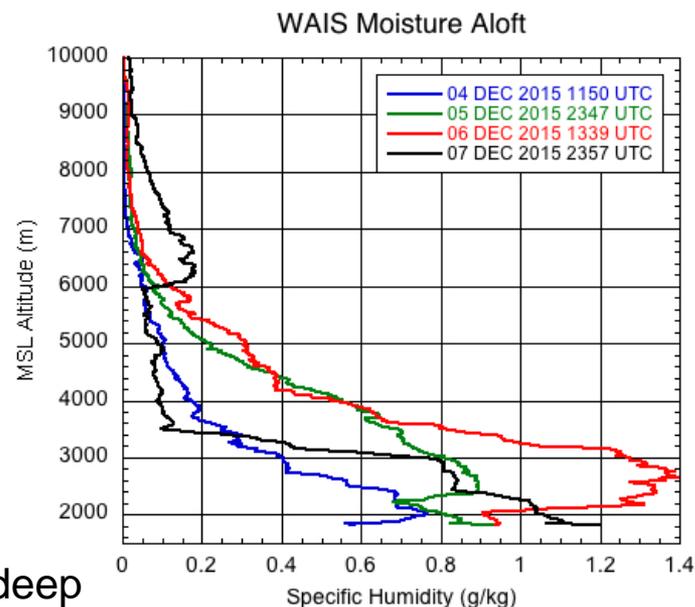
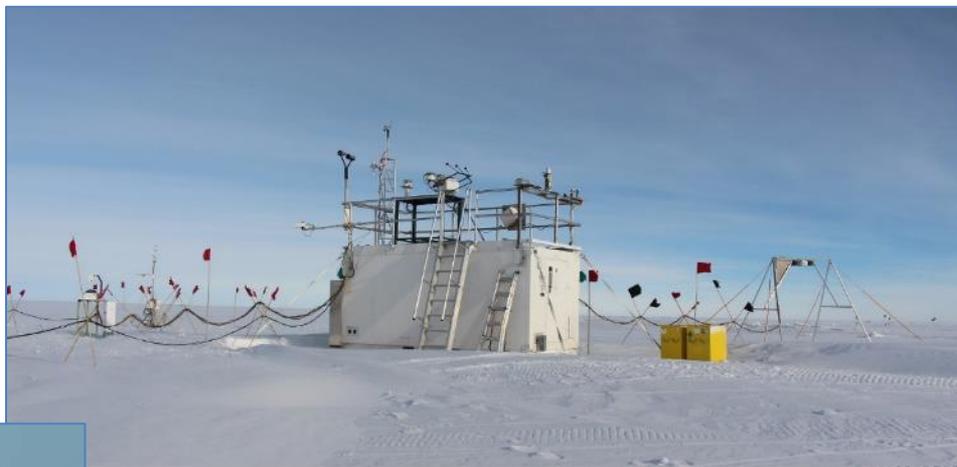
ARM Mobile Facility 1 and Mobile Aerosol Observing System

- Green Ocean in the Amazon (GoAmazon) closeout
 - Presentation by PI Scot Martin later this morning
 - Clouds/precip breakout session yesterday [Feng/Machado]
 - Poster session today; aerosol breakout session this evening
- Layered Atlantic Smoke Interactions with Clouds (LASIC)
 - PI – Paquita Zuidema
 - AMF installation currently in progress
- MAOS-A → AMF1 AOS; MAOS-C → MAOS



ARM Mobile Facility 2

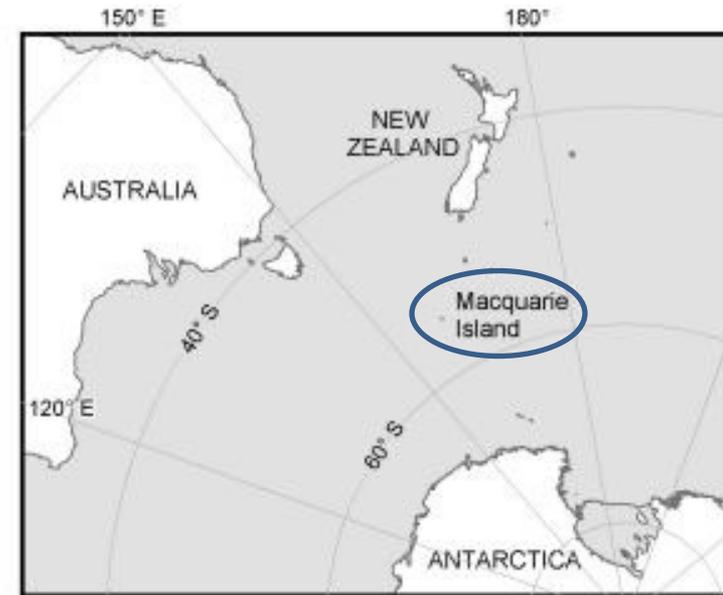
- ARM West Antarctic Radiation Experiment (AWARE) PI – Dan Lubin
 - McMurdo Base; AMR1 deployed Dec 2015 – Dec 2016
 - West Antarctic Ice Sheet (WAIS); SKIP deployed Dec 2015 – Jan 2016



- First radiosondes launched on WAIS since 1967; show deep layer of moisture that accompanies storms arriving on WAIS from the Southern Ocean
- Paper in prep on significant warming event at WAIS accompanied by widespread surface melting in West Antarctica

Off-Site Campaigns (OSC)

- Macquarie Island Cloud Radiation Experiment (MICRE)
- PI – Roger Marchand
 - Spring 2016 – 2018
 - Clouds & radiation in Southern Ocean



Barrow (NSA) & Oliktok Point (AMF3) Updates

- DOE site visit to Barrow and Oliktok, March 2016
- An operational monitoring weather display has been developed for the two ARM North Slope sites.
 - Pulls NWS and NCEP weather forecast model data for Barrow and Oliktok
 - Will be used to monitor expected conditions at the sites over the winter in order to protect personnel and equipment instrumentation.
 - Sends email notifications to personnel when adverse operating conditions are expected
- New severe weather operations plan



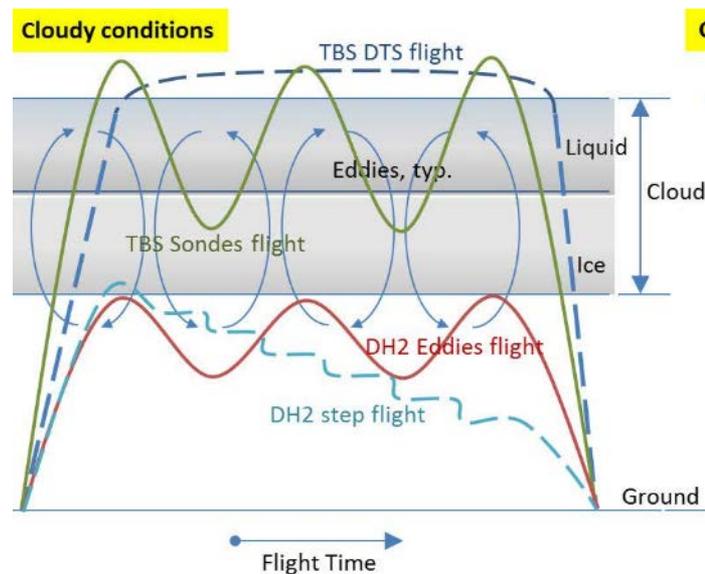
Barrow (NSA) & Oliktok Point (AMF3) Updates

- Radar Calibration Grooming Activity (CGA) for SACR at Oliktok, October 2015
- New agreement to house ARM staff at ENI “NOC” Camp near Oliktok, reduces need for lodging and support from staff at Oliktok radar station.
- Preparing for AOS installation at Oliktok, late summer 2016



ARM Routine Tethered Balloon System (TBS) and Unmanned Aerial Systems (UAS) Activities

- Current focus on Oliktok due to availability of special use airspace
- Activities jointly managed by North Slope team (SNL) and ARM Aerial Facility (PNNL)
 - SNL: Tethered balloons; Oliktok airspace; Oliktok ground support; IOP support
 - PNNL: UAS capabilities & flights
- Based on previous workshops & discussions with Oliktok science team determined sampling strategies and science priorities for ARM routine UAS and TBS operations at Oliktok
 - **Inaugural Campaigns for ARM Research using Unmanned Systems (ICARUS)**
 - TBS & UAS flights this summer; developing future platform & sensor capabilities

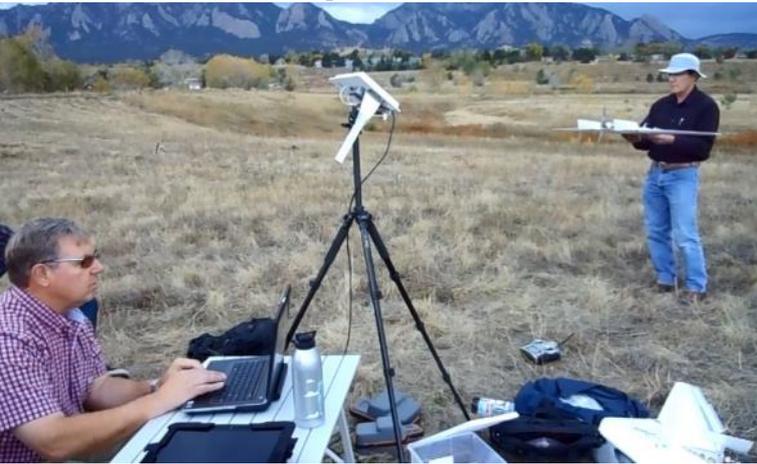


Oliktok Tethered Balloon System (TBS)

- Beginning 'routine' TBS operations at Oliktok
 - Planning ~4 deployments/year
 - Testing and operating different balloons & sensors
- April 18-19 Deployment
 - Operated TBS in conditions of -15C and 13 m/s winds
 - Operated tethersonde, wetness sensors, distributed temperature sensors
- Future activities:
 - New trailer & balloon to enable higher alt flights
 - New sensors: POPS, replicator, turbulence package
- Poster talk by Dari Dexheimer



ARM Aerial Facility UAS Capability Development



- Small UAS - DataHawk

- Pilot training & procurement of 4 units (2015)
- PNNL flights in Pendleton, OR UAS Range (Mar – May 2016)
- Beginning of routine operations (ICARUS):
 - June-Aug 2016: 7 weeks of flights at Oliktok
 - Atmospheric temperature, pressure, humidity; surface temperature; infer wind and turbulence

- MidSize UAS - TigerShark

- Wingspan 21' 3"; max payload 100 lbs; Payload Power 2500 W; 4 Underwing Hardpoints
- Max Altitude 15 kft; endurance 10-12 hrs
- Contract placed, expect delivery Jan 2017
- Pilot training, instrument integration, testing in non-Arctic conditions required before research deployment at Oliktok
- Exploring instrument sensors & de-icing technologies

TigerShark XP



Aerial Facility Activities

- Integrating AAF datasets into ARM standard ingest & processing
- **ARM Carbon Measurement Experiment (ACME V); PI: Sebastien Biraud**
 - G-1 to Deadhorse, AK (June – Sep, 2015)
 - Carbon cycle gases, clouds, aerosols & radiation
 - 38 Research flights, 141 hours
- **Holistic Interactions of Shallow Clouds, Aerosols, and Land-Ecosystems (HI-SCALE); PI Jerome Fast**
 - Goal: understanding lifecycle of shallow clouds by coupling cloud properties to land surface properties, ecosystems, and aerosols.
 - Two 4-week IOPs in spring and late summer
 - 4 research flights to date (as of May 1)

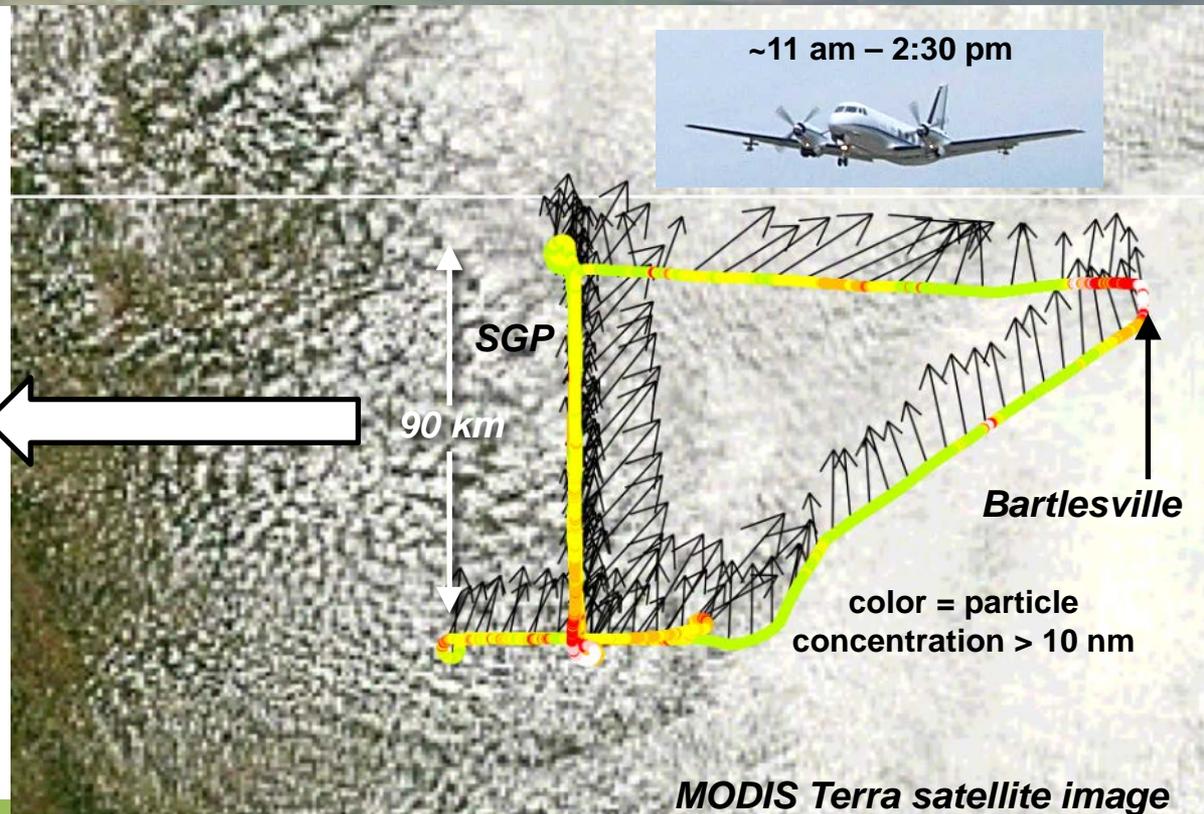
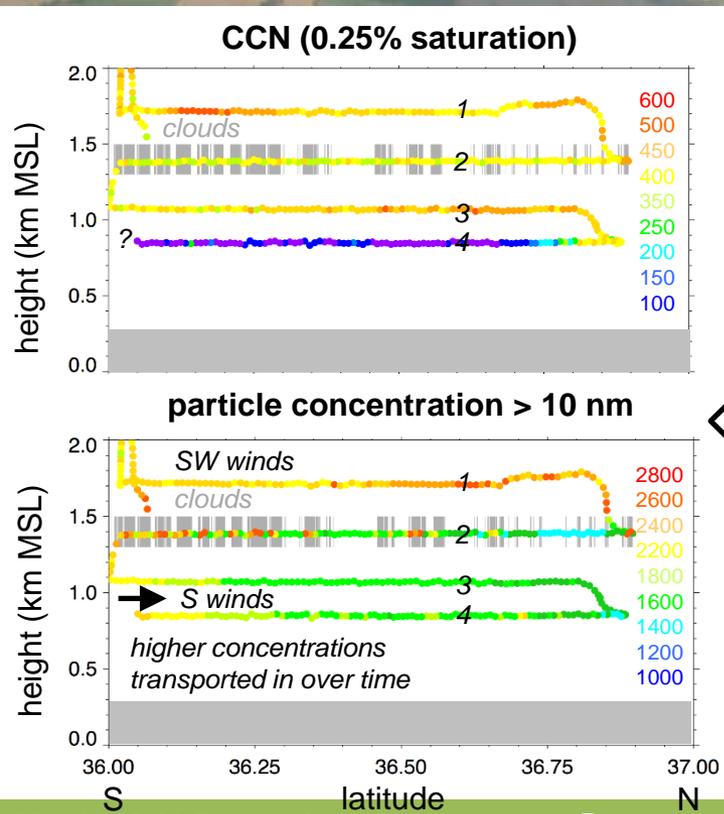


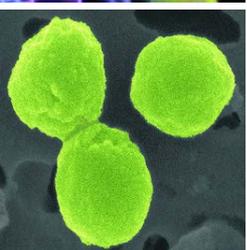
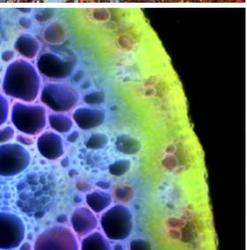
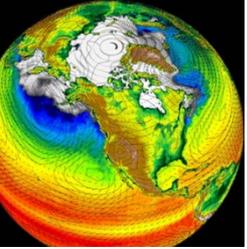
Holistic Interactions of Shallow Clouds, Aerosols, and Land-Ecosystems (HI-SCALE)

Phase 1: April 24 – May 20



first G-1 flight: April 25, heterogeneity in clouds, aerosols, and land surface





Recently completed campaigns



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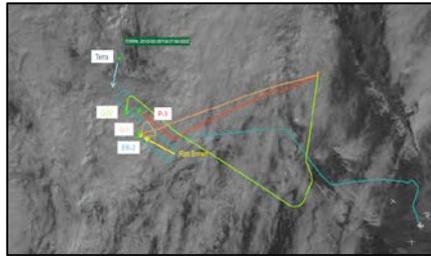
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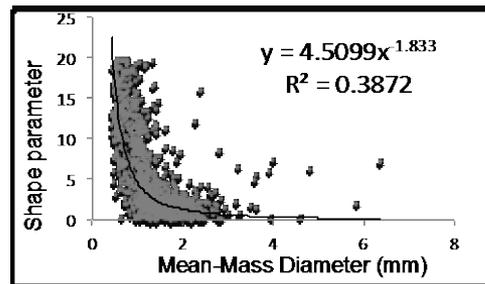
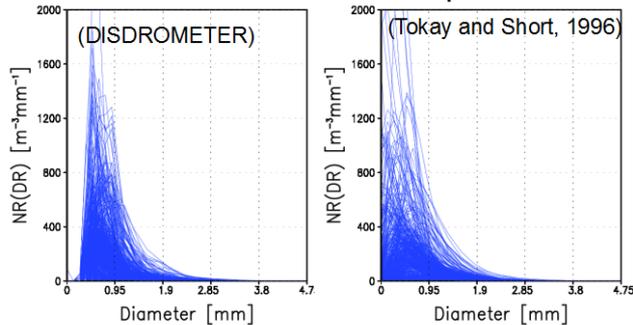
Microphysics and aerosols in an atmospheric river observed during ACAPEX

Coordinated flights over Ron Brown on February 5

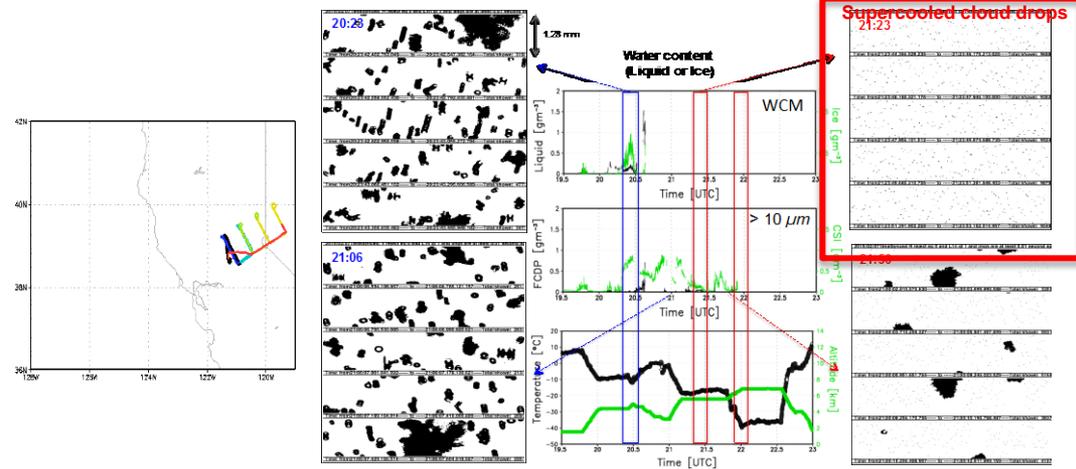
G-1 flight on February 7 in the Sierra Nevada



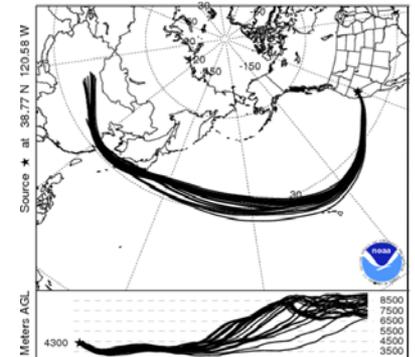
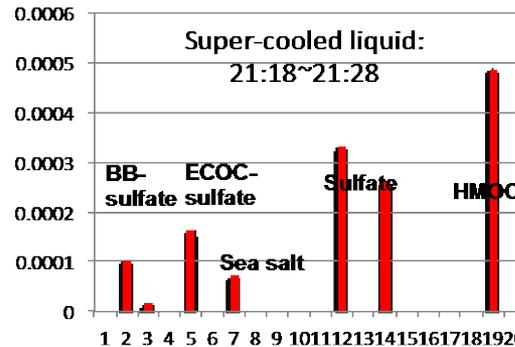
Size Distribution of rain drops



- Some bulk microphysics schemes assume that the shape parameter for rain increases with increasing D_m , but observations from ACAPEX show the opposite



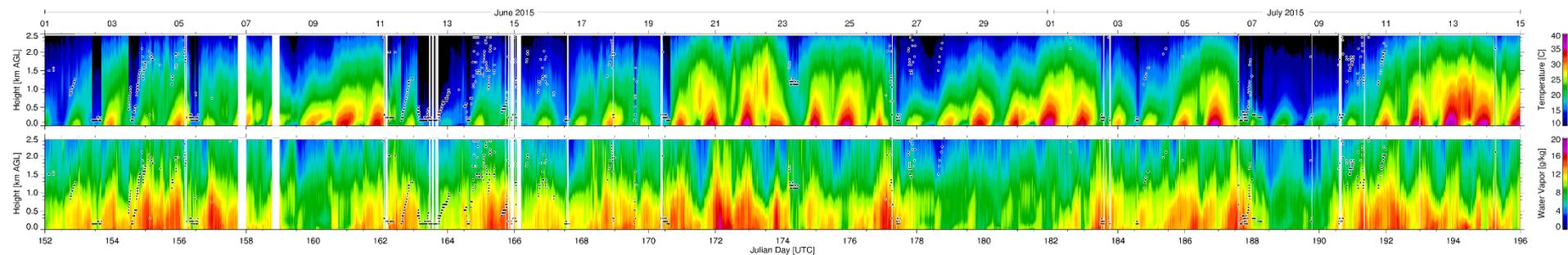
Presence of absorbing aerosols Aerosols from long-range transport



- With absorbing aerosols from long-range transport, the low CCN hygroscopicity and low INP allow small supercooled droplets to exist at very low temperatures (-38°C), which expand the mixed phase zone and affect precipitation mechanisms

ARM Support for Plains Elevated Convection at Night (AS-PECAN)

- The PECAN field campaign deployed an unprecedented network of integrated sounding systems, mobile radars and mesonets, and aircraft over the Great Plains during June-July 2015 to better understand nocturnal mesoscale convective systems
 - Focus on convective initiation, bores, low level jet, MCSs, and predictive modeling
- ARM contributed AERIs to the fixed PECAN Integrated Sounding Arrays (PISAs)
- BAMS paper recently submitted



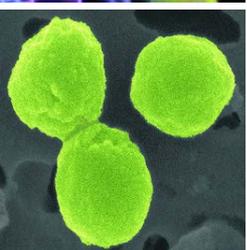
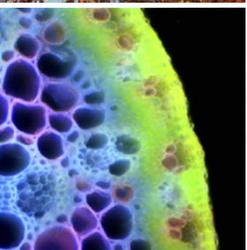
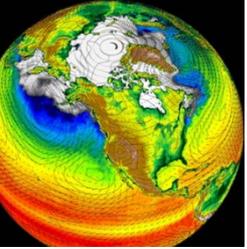
- 45-day time-height cross-section of the temperature and water vapor retrieved from the AERI at the Ellis Kansas PISA site

ERASMUS

- UAS flights at Oliktok Point for aerosol, surface fluxes, boundary layer
- PI: Gijs de Boer; April 2016
- Six Pilatus flights in two days:
 - POPS aerosol spectrometer, SPN-1 shortwave radiometers, the CGR-4 long wave radiometers, NCAR dropsonde package
- Other activities:
 - Carried out extensive surface-based aerosol sampling with POPS during days not able to fly; these were the first aerosol size distribution measurements at Oliktok Point
 - Conducted surface-based intercomparison between the AAF radiometers and the SkyRad system on the roof of the AMF3



Gijs de Boer and Doug Weibel battle below-zero temperatures and 30+ mph winds to launch the UAS.



Upcoming Campaigns



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Upcoming campaigns

- ACE-ENA (Aerosol and Cloud Experiments in the Eastern North Atlantic)
 - PI Jian Wang, BNL
 - G-1 campaigns around ENA in June-July 2017 and Jan-Feb 2018
 - Comprehensive in-situ characterizations of boundary layer structure, and associated vertical distributions and horizontal variabilities of low clouds and aerosol over the Azores
 - Breakout session Wed evening
- MARCUS (Measurement of Aerosols, Radiation and CloUds over the Southern Oceans)
 - PI Greg McFarquhar, U. Illinois
 - AMF2 deployed on *Aurora Australis* as it conducts multiple supply transits between Tasmania and Antarctica; Sep 2017 – Apr 2018
 - Goal: improve understanding of clouds, aerosols, air-sea exchanges and their interactions over the Southern Ocean
 - Breakout session this evening



Aurora Australis; Australian Antarctic Division

Upcoming campaigns

- CACTI (Cloud, Aerosol, and Complex Terrain Interactions)
 - PI Adam Varble, U. Utah
 - AMF1 deployed to Sierras de Córdoba mountain range of north-central Argentina; Aug 2018 – April 2019
 - Goal: improve understanding of cloud lifecycle and organization in relation to environmental conditions in order to improve cumulus, microphysics, and aerosol parameterizations
 - Breakout session this evening
- MOSAiC Atmosphere
 - PI Matt Shupe, U. Colorado/NOAA
 - AMF2 deployed on *Polarstern* icebreaker, which will be frozen into and drift with Central Arctic sea-ice for 1 year; Sep 2019 – Oct 2020
 - Target atmosphere and atmosphere-surface interactions that are critically under-observed in the Arctic and are leading contributors to model uncertainties in the region
 - Breakout Session Wed evening



By <http://www.flickr.com/photos/galloreale/2874765559/>, CC BY 2.0, <https://commons.wikimedia.org/w/index.php?curid=13656074>



Polarstern
Alfred Wegner Institute

ARM-EMSL Pilot Projects

- Recent pilot project with Environmental Molecular Science Facility (EMSL), another Office of Science User Facility
- Requested proposals that:
 - advance the understanding of the molecular, physical, and/or optical properties of aerosol particles that influence and control macroscopic climate-relevant processes
 - focus on collection of samples at the surface or near surface at ARM's Southern Great Plains (SGP) site in Oklahoma with subsequent analysis of those samples at EMSL.
- Convened joint review panel; selected 4 proposals for support:
 - Mary Gilles, “Chemical Imaging and Molecular Characterization of Solid Organic Particles Discovered in the Area of Southern Great Plains”
 - Jian Wang, “Growth of newly formed particles and formation of cloud condensation nuclei”
 - Susanne Hering, “Chemical Composition of Newly-Formed Organic Aerosols by Spot-Sampler nano-DESI”
 - Ryan Moffet, “Microscopic Observations of Aerosol Mixing State at the Southern Great Plains”