



# ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

13 – 17 November 2023 | ESA-ESRIN, Frascati (Rome), Italy

## EVID40: ARM Facility Measurements for Validation and Research

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# ARM Facility Overview



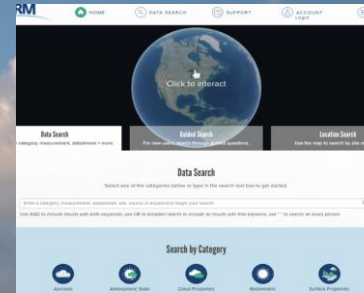
Measurements of clouds, aerosols, precipitation, radiation, surface properties, and the atmospheric state since 1992



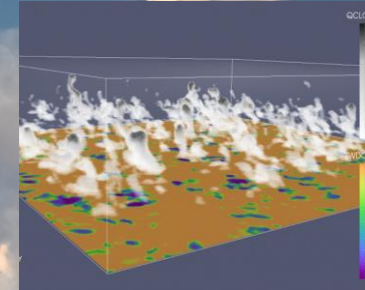
Network of three fixed-location and three mobile observatories



Piloted and uncrewed aerial measurement platforms



Extensive data management infrastructure; data freely available



Large-eddy simulation (LES) model simulations and analysis tools



Support for field campaigns ranging from guest instruments to facility deployments

Support for process studies and model and satellite development



# Measurements and Locations



## Baseline Instruments Include:

- Surface meteorology, radiation and heat fluxes
- Radiosonde T/RH profiles
- Microwave radiometer, IR interferometer
- 35 GHz cloud radar, micropulse lidar, Doppler lidar
- Hemispheric sky imager
- In situ aerosol number, size, and CCN (coming to NSA)

## Additional Instruments at Select Locations:

- Raman Lidar (water vapor/aerosol): SGP, BNF, ENA
- High Spectral Resolution Lidar: SGP, BNF\*, NSA\*
- Scanning radars\*\*: SGP, NSA, ENA, BNF

[www.arm.gov/capabilities/observatories/instruments](http://www.arm.gov/capabilities/observatories/instruments)



Southern Great Plains (SGP)



North Slope of Alaska (NSA)



Eastern North Atlantic (ENA)



Southeast U.S. (BNF) 2024-29



Tasmania, AU 2024-25



Maryland, US 2025



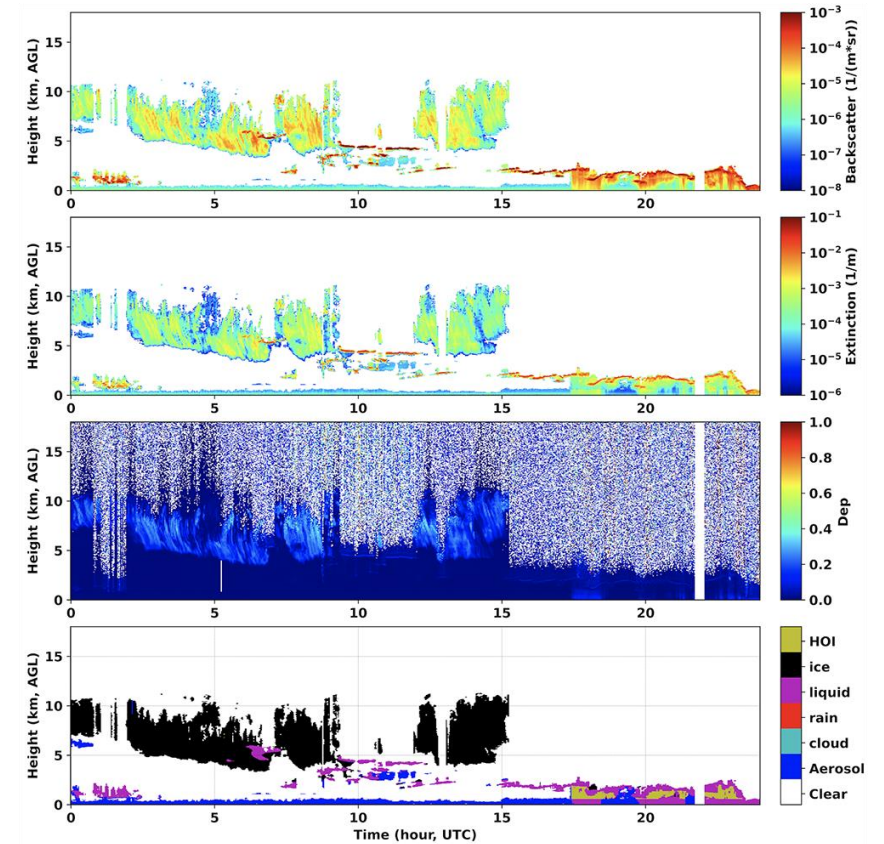


ARM measurements are first processed to “b1” level, providing base geophysical parameters – usually based on a single instrument.

Additionally ...

## Value Added Products

- KAZRARSCCL: Ka-band Active Remote Sensing of Clouds – cloud boundaries and reflectivity best estimate
- MPLCMASKML: Machine Learning-based Micropulse lidar cloud mask
- QCRAD: Best estimate broad band fluxes
- RLPROF-FEX: Raman lidar feature mask and extinction profiles
- TROPoe: FTIR (AERI) optimal estimation retrieval of T/RH profiles



Raman Lidar Profiles – Feature Detection and Extinction (D. Chand et al., 2022).

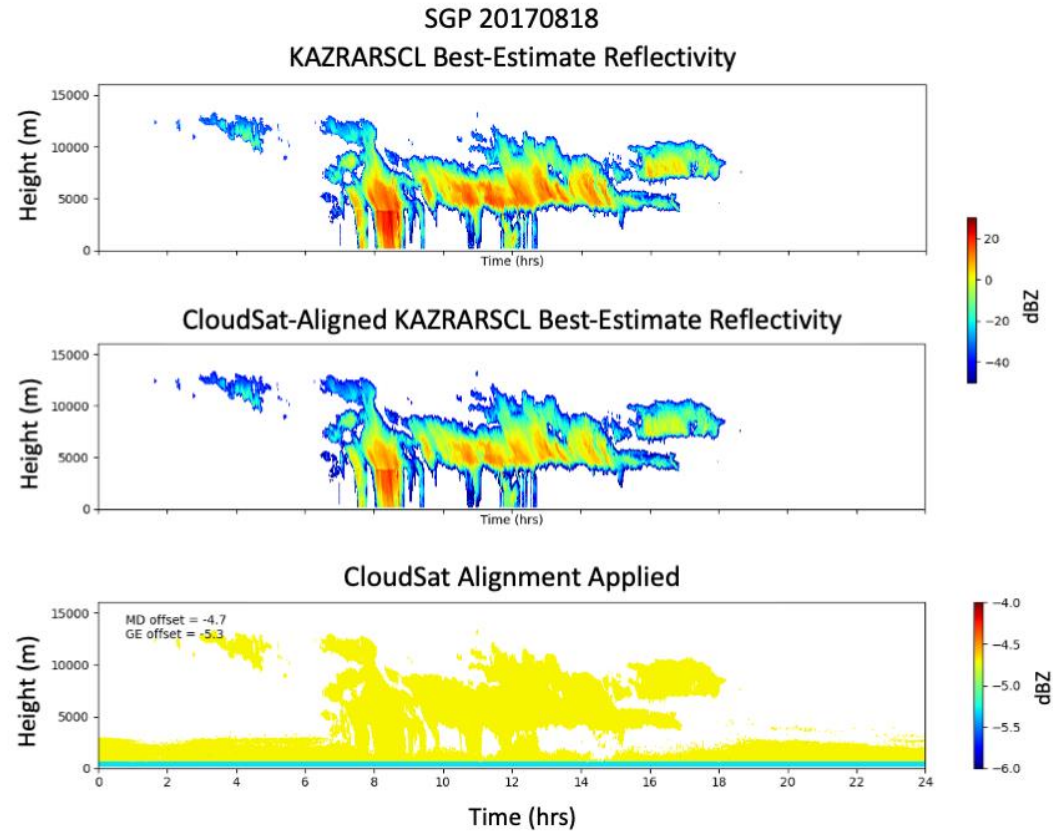
[www.arm.gov/science-data-products/vaps](http://www.arm.gov/science-data-products/vaps) (valued added products)



- Intelligent search based on user's comfort area with advanced metadata and cutting-edge technologies
- Recommended data streams and data tagging
- Newly developed spatiotemporal viewer ("Location Search") for ARM field campaign data
- Ability to drill down for detailed information
- Tutorial videos and more information @ <https://www.arm.gov/data/>

The screenshot displays the ARM Data Search web application. The interface includes a navigation bar with 'HOME', 'DATA SEARCH', 'SUPPORT', 'ACCOUNT Login', and 'CART'. A search bar at the top prompts users to enter a category, measurement, datastream, site, source, or keyword. Below the search bar, the results show 28 data products, with filters for 'Cloud Properties' and 'Field Campaign: Tracking Aerosol Convection Interactions Experiment (TRACER)'. A table lists data products with columns for 'Data Product', 'Description', and 'View Details & Get Data'. The 'Location Search' section is expanded for the 'HOU' site, showing 'Houston, TX; Tracking Aerosol Convection Interactions Experiment (HOU)' and 'Houston, TX; AMF1 (main site for TRACER) (M1)'. A 'Feedback' button is visible on the right side of the interface.

Data Product	Description	View Details & Get Data
csphotlmv3	Cimel Sunphotometer (CSPHOT): almucantars sky radiance data, version 3	^
csphotppv3	Cimel Sunphotometer (CSPHOT): principal planes data, version 3	v
met	Surface Meteorological Instrumentation	v
aosccn2colaavg	AOS: Cloud Condensation Nuclei Counter (Dual Column), ramping mode averaged	v
sondewnpn	Balloon-borne sounding system (BBSS): Vaisala-processed winds, press., temp, &RH	v



- Alignment of ARM radars and/or lidars with EarthCARE
- Harmonization of ARM datastreams with ACTRIS, NASA, and NOAA
- Development of special datastreams (e.g. merged data products)

35 GHz ARM Radar (KAZR) – CloudSat alignment: KAZRARSCLCLOUDSAT (K. Johnson et al., 2022) following P. Kollias et al. (2019)



## Tethered Balloon System

- Max altitude ~1.5km; payload ~50 kg
- Measurements: aerosol size, number, filter-based composition
- Deployments on proposal-driven basis. Next call expected in January



## Uncrewed Aerial System: ArcticShark

- Comparable payload and access process as Tethered Balloon
- Clear-air flights only to altitude of ~5 km



## Regional Jet: Challenger 850 (CRJ200)

- Currently undergoing modifications (wing pylons, fuselage probes)
- Expected delivery in CY2025; science flights in CY2026

[www.arm.gov/capabilities/observatories/aaf](http://www.arm.gov/capabilities/observatories/aaf)

# Applying for Field Campaigns



- Deployment of ARM Mobile Facilities – call for deployments beginning mid-2026 opens Friday Nov 17. Proposals due Feb 9.
- Call for tethered balloon operations at select site in 2025, call for proposals opens January
- Requests to host guest instruments or to operate instruments in special ways (e.g. special radar scans) can be submitted at any time and are reviewed monthly
- The starting point for any of these activities is through submission of a preproposal from the campaigns web page



[www.arm.gov/research/campaigns](http://www.arm.gov/research/campaigns)





# Summary



- ARM measurements are openly available from three fixed-location, three mobile observatories, and aerial platforms
- Potential for special data activities supporting EarthCARE including coordination with ACTRIS (ideas welcome)
- Field campaign process provides a mechanism to augment, modify, or deploy ARM observatories



## ATMOSPHERIC RADIATION MEASUREMENT USER FACILITY

### CONNECT WITH ARM

CREATE ACCOUNT

ORGANIZATION



Reviewed September 2021

### POLICIES

DATA POLICIES

CAMPAIGN GUIDELINES

LINKING POLICIES

PRIVACY & SECURITY NOTICE

DIVERSITY, EQUITY, & INCLUSION

VULNERABILITY DISCLOSURE PROGRAM

### HELP

ASK US

ASK A UEC MEMBER

DATA QUESTIONS

FAQS

ACCOUNT MANAGEMENT

My contact: [Jim.Mather@pnnl.gov](mailto:Jim.Mather@pnnl.gov)