



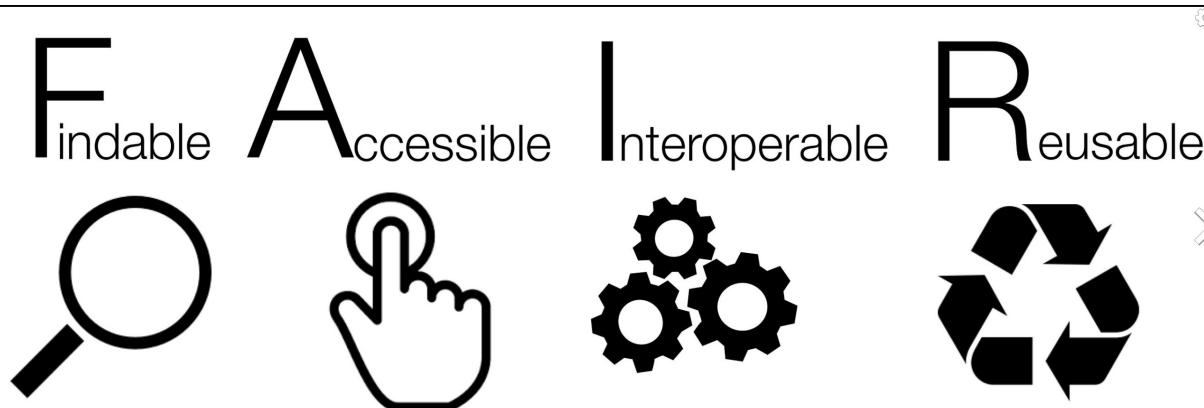
Finding YOUR ARM Data – A Tutorial Open-Science-Workshop-2022

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G. Prakash, Ric Cederwall, Hannah Collier, H. Shanafied

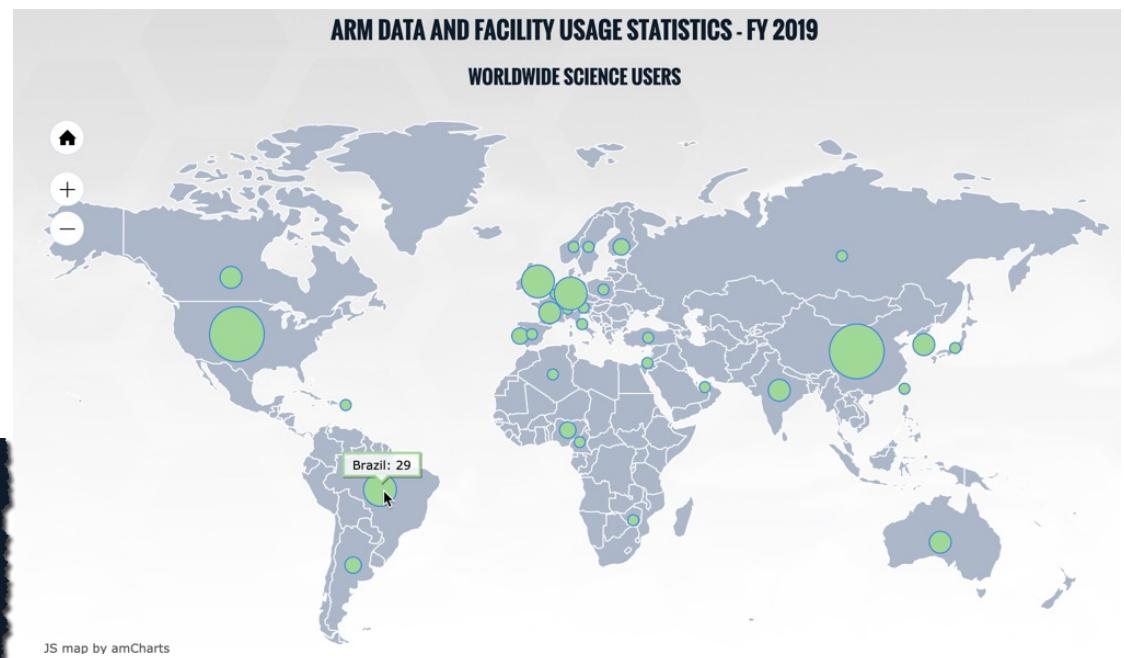
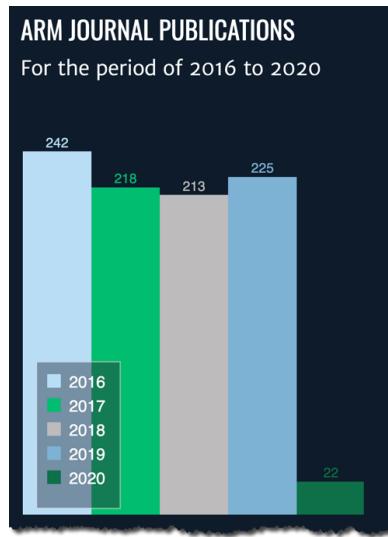
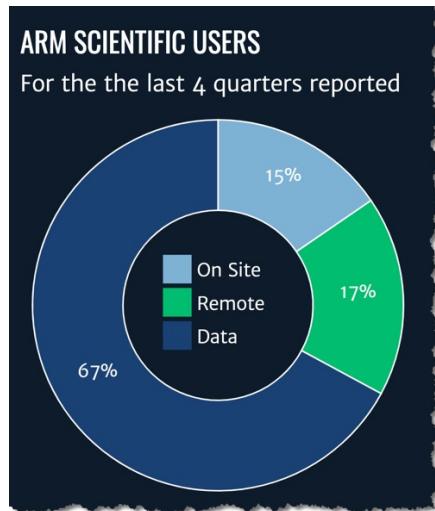
Summary

- ▶ ARM facilitates easy discovery for users through an interactive portal and accompanying details pages
- ▶ Longevity of data relies on full metadata – promotes long term preservation,
- ▶ Enables data interoperability;
- ▶ Provides proper credit to data contributors



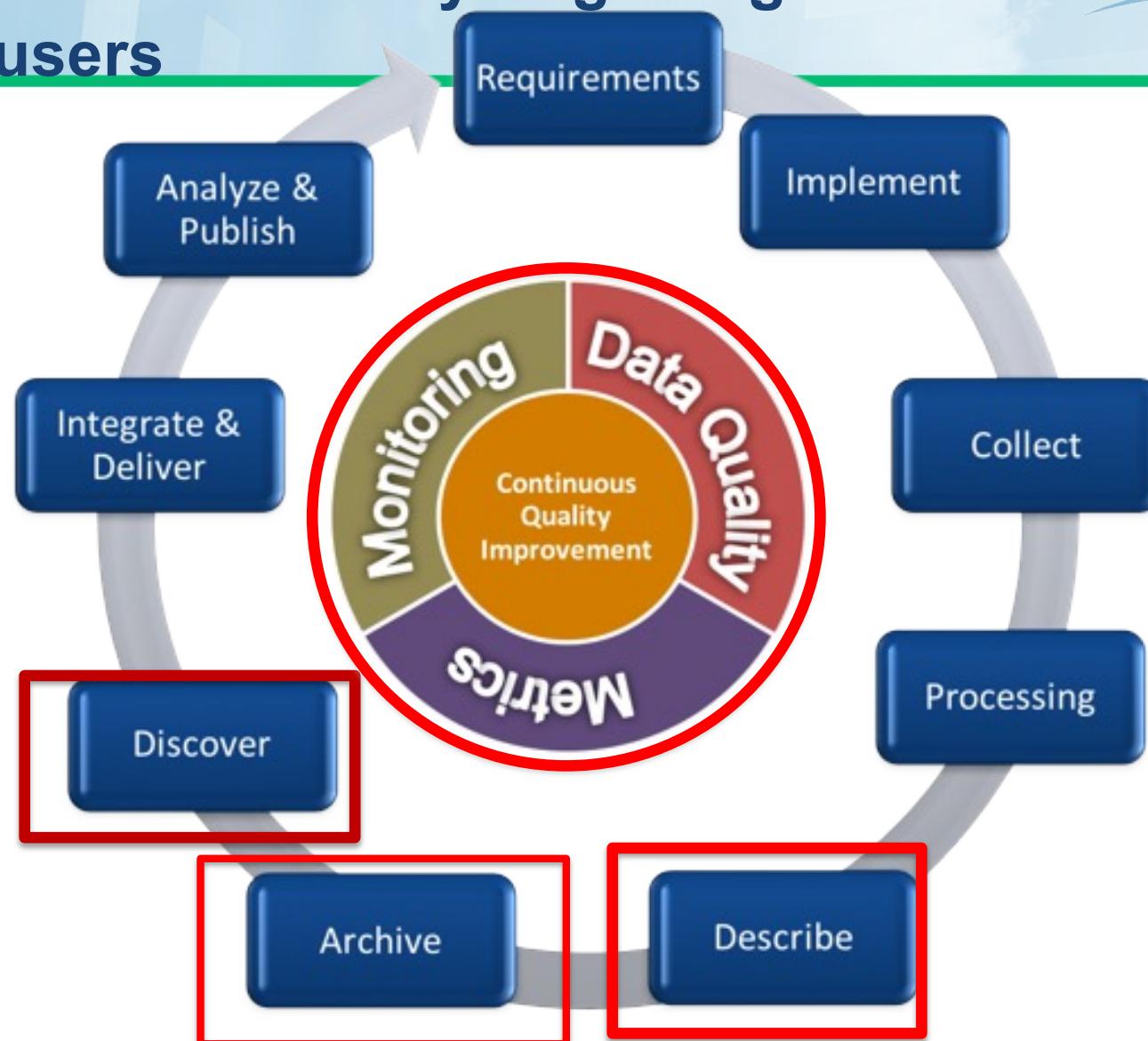
ARM Data Center (ADC)

- 450+ instruments deployed
- 2000+ active data streams
- >2 PB of Archived data
- 1,000+ Unique scientific users
 - ▶ > 200+ publications/yr

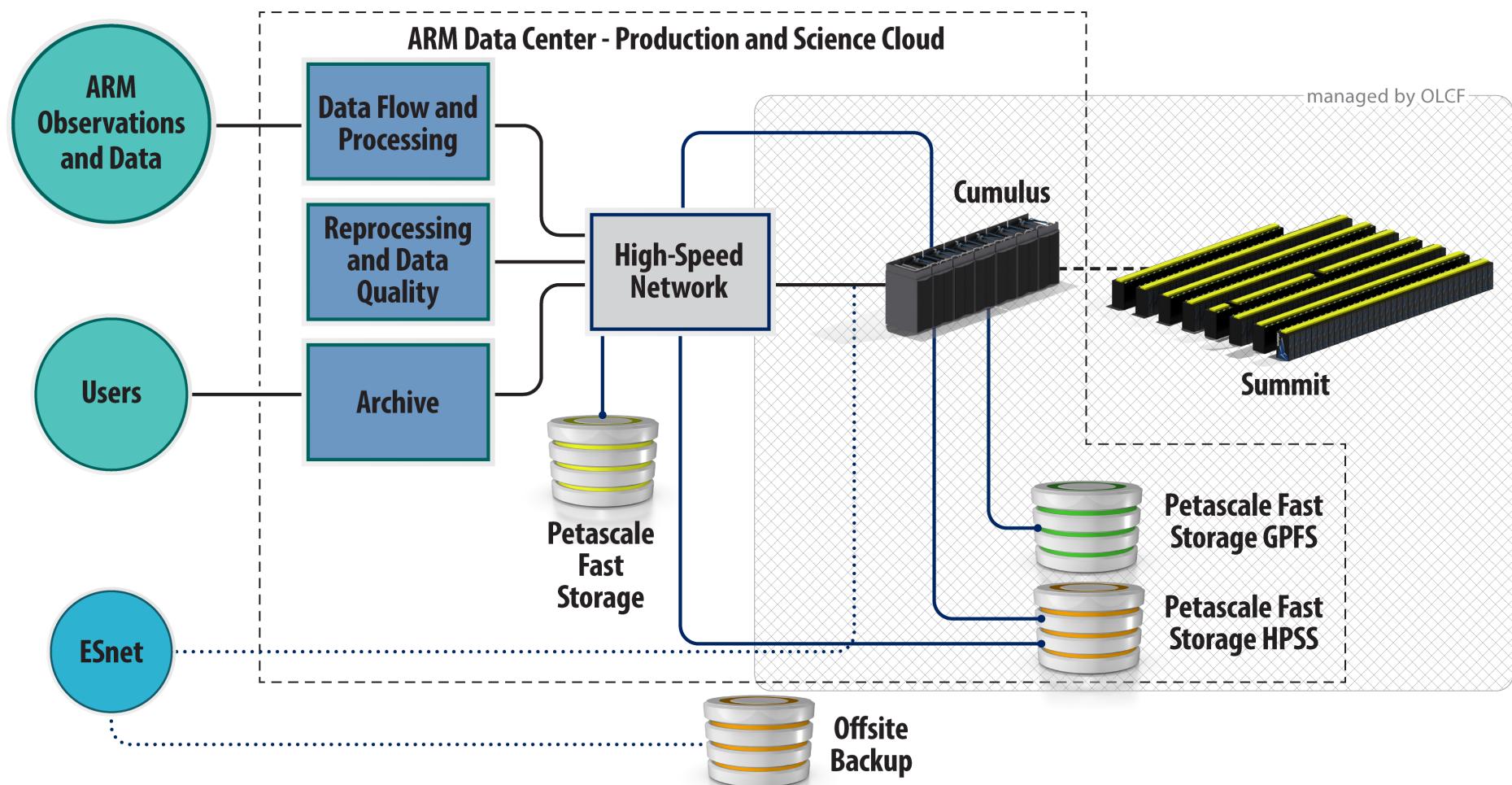


A key contributor to climate research

What is metadata: we work with scientists, complete metadata key to getting science & data to users

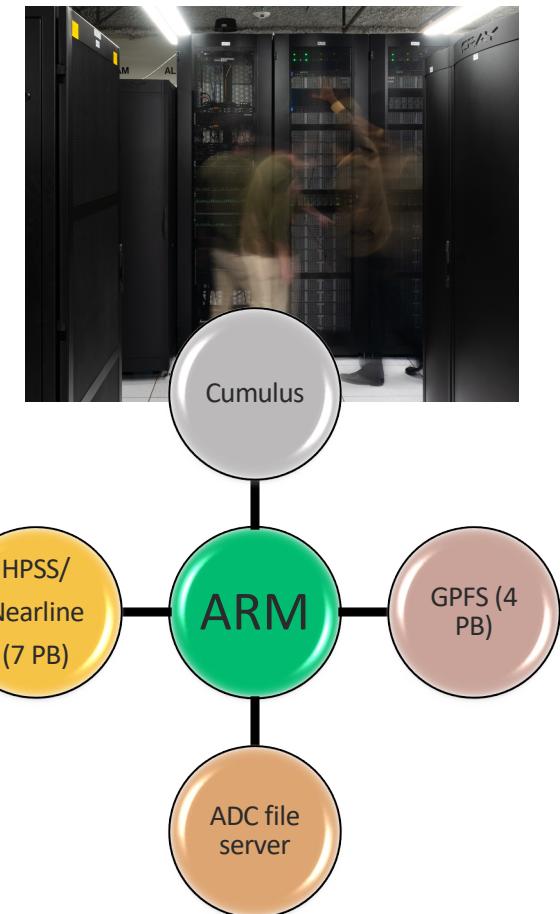


ARM - Community Computing Architecture



The New Cumulus Cluster

- ▶ The new cluster offers a dense node architecture (128 cores per node)
- ▶ Provides 16,384 total computing cores
- ▶ 4 PB Global Parallel File System (GPFS)
- ▶ Deployed within NCCS open security enclave; providing seamless connections between ADC database, next generation-HPSS, and ARM HPC
- ▶ Support for *Singularity containers* (improve application portability)
- ▶ Jupyter notebook support (available soon)
- ▶ Wide range of software stacks (compilers (GCC/Intel), open source libraries, IDL, MatLab etc..)



HPC Science projects: Cumulus request via HPCR :
<https://arm.gov/capabilities/computing-resources>

Find your data on our website



<https://arm.gov/>



U.S. DEPARTMENT OF
ENERGY

Office of
Science

DATA ▾

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ABOUT ▾

Search ARM.gov



Atmospheric Observatories

➢ Instruments

VAPs

Modeling

Computing Resources

e.g., <https://arm.gov/research/campaigns>

<https://arm.gov/research/campaigns/amf2021tracer>

The world's premier ground-based observations facility advancing atmospheric and climate research

DOES POLLUTION MAKE THUNDERSTORMS MORE SEVERE?

To find out, researchers will study the effects of aerosols on storms in the Houston, Texas, area for a full year.

UNDERSTANDING THE FUTURE OF WATER

A 21-month ARM campaign in Colorado will establish what is being called "the world's first bedrock-to-atmosphere mountain integrated field laboratory."

ARM'S DECADAL VISION, PART 1

The first article in a series about ARM's four Decadal Vision themes details how ARM intends to improve measurement strategies and instruments.



[BROWSE DATA](#)

https://adc.arm.gov/discovery/#/results/site_code::guc/start_date::2021-09-01/end_date::2023-06-15



GUC DATA SOURCES

NAME	FULL NAME	BROWSE DATA
ACSM	Aerosol Chemical Speciation Monitor	Browse Data
AERI	Atmospheric Emitted Radiance Interferometer	Browse Data
AOS	Aerosol Observing System	Browse Data
AOSMET	Meteorological Measurements associated with the Aerosol Observing System	Browse Data
AOSSP2BC	Aerosol Observing System Single Particle Soot Photometer Black Carbon	Browse Data
CAMINST	camera that monitors an instrument	Browse Data
CAMSITE	camera that monitors a site area	Browse Data
CCN	Cloud Condensation Nuclei Particle Counter	Browse Data
CEIL	Ceilometer	Browse Data
CO-ANALYZER	Carbon Monoxide Analyzer	Browse Data

Categorized: instruments and VAPs into classes



<https://arm.gov/>



DATA ▾

CAPABILITIES

RESEARCH ▾

NEWS & EVENTS ▾

ABOUT ▾

Search ARM.gov



Atmospheric Observatories

➢ Instruments

VAPs

Modeling

Computing Resources

E.g., keyword search under instrument, VAP, or data-sources lists

FILTER

Showing 1 of 1

NAME	FULL NAME	ACTIVE	TYPE	START	END
SO2-AIR	Sulfur Dioxide Monitor aboard Aircraft	✓	Baseline	25 April 2016	8 December 2018

Showing 1 of 1

We offer various ways to search data on DD



Data Search

Search by category, measurement, datastream + more.

A screenshot of a search interface. A search bar at the top contains the text "tracer". Below the search bar, there are two sections: "Field Campaign" and "Facility". Under "Field Campaign", a result for "amf2021tracer" is shown as "Tracking Aerosol Convection Interactions Experiment (TRACER)". Under "Facility", two locations are listed: "hou.M1" (Houston, TX; AMF1 (main site for TRACER)) and "hou.X10" (Houston, TX; External Data at main site for TRACER).

tracer

Field Campaign

amf2021tracer Tracking Aerosol Convection Interactions Experiment (TRACER)

Facility

hou.M1 Houston, TX; AMF1 (main site for TRACER)

hou.X10 Houston, TX; External Data at main site for TRACER

Search by classes of instruments, type of data, and more.



Aerosols



Atmospheric State



Cloud Properties



Radiometric



Surface Properties

Search by campaign name or site:

Field Campaign Data Products

Data from intensive field campaigns that are conducted by ARM, these include routine as well as PI contributed data.

We will start with the first and most popular:
key word searching facilitates discovery by various parameters of interest

ARM

<https://adc.arm.gov/discovery/#/>

The screenshot shows the ARM Data Discovery website. At the top, there is a navigation bar with links for HOME, DATA SEARCH, SUPPORT, ACCOUNT, and CART. Below the navigation bar, a large circular graphic with a hand icon and the text "Click to interact" is visible. On the left, a sidebar labeled "Data Search" contains a search input field with the placeholder "Search by category, measurement, dataset". In the main content area, the word "pressure" is typed into a search input field. Below this, the word "Measurement" is displayed. A teal button labeled "atmpres" is shown next to the text "Atmospheric pressure". At the bottom, a green link provides the URL <https://adc.arm.gov/discovery/#/results/s::pressure>. The bottom right corner of the slide has the number "13".

Recommendations: facilitating discovery by various parameters of interest from data discovery (DD) <https://adc.arm.gov/discovery/#/>



Core measurement	
Aerosol Optical Depth	Ice Generalized Effective Diameter
Aerosol Extinction	Ice Water Content
Angstrom Parameter	Ice Water Path
Asymmetry Parameter	Liquid Effective Radius
Backscatter depolarization ratio	Liquid Water Content
Backscattered Radiation	Liquid Water Path
Advective Tendency of Temperature (VAP)	Broadband Surface Albedo
Horizontal Wind Direction Profile	Downwelling Broadband LW Flux
Horizontal Wind Speed Profile	Broadband LW Flux Profile
Large-Scale Vertical Velocity	Downwelling Broadband SW Flux
Precipitation Drop Size Distribution	Broadband SW Flux Profile
Precipitable Water	Single Scattering Albedo
Precipitation	Surface Skin Temperature
Pressure	Spectral LW Flux
Surface Pressure	Spectral SW Flux
Relative Humidity	Spectral Surface Albedo
Relative Humidity at Surface	Ground Heat Flux
Temperature	Latent Heat Flux
Surface Temperature	Sensible Heat Flux
Water Vapor Mixing Ratio	Soil Moisture Content
Wind Direction at Surface	Horizontal Wind Components
Wind Speed at Surface	Horizontal Wind Components at Surface
Cloud Optical Depth	Greenhouse Gas
Cloud Cover	Advective Tendency of Moisture (VAP)
Cloud Frequency	Advective Tendency of Moisture (VAP)
Cloud Location	Upwelling Broadband LW Flux
	Upwelling Broadband SW Flux

Results can be filtered, for example by the campaign of interest



<https://adc.arm.gov/discovery/#/results/iopShortName::amf2021tracer>

Field Campaigns 1
 Tracking Aerosol Convection Interactions 38
Experiment (TRACER)
Clear » Apply »

Data Type 1
Datastreams 45
Facilities 4
Data Levels 2
Source 30
Data Products 38
Instrument Category 6

Hide Advanced Filters

Data Product	Description	View Details & Get Data
csphotalmv3	Cimel Sunphotometer (CSPHOT): almucantars sky radiance data, version 3	▼
csphotppv3	Cimel Sunphotometer (CSPHOT): principal planes data, version 3	▼
gndirt	Infrared Thermometer: Ground surface temperature	▼
met	Surface Meteorological Instrumentation	▼
mfrsr7nch	Multi-Filter Rotating Shadowband Radiometer (MFRSR) with 7 Narrowband Channels: raw irradiances	▼
sondewnpn	Balloon-borne sounding system (BBSS): Vaisala-processed winds, press., temp, &RH	▼
vdis	Video Disdrometer Drop Size Distribution	^

Sites:
 HOU

Location
Houston, TX; Tracking Aerosol Convection interactions ExpeRiment (HOU)
Houston, TX; AMF1 (main site for TRACER) (M1)

Abundant details in this view includes: Levels of data available, DOI assigned by data level and available in multiple formats



https://adc.arm.gov/discovery/#/results/id::houvdisM1.b1_median_volume_diameter_micro_vdis_sfcmet?dataLevel=b1&showDetails=true

VDIS

Selected data level ?

b1 Start: 2021-08-07
End: 2022-01-09

b1: QC checks applied to measurements

Description: Video Disdrometer Drop Size Distribution

Site: Houston, TX; Tracking Aerosol Convection interactions ExpeRiment (HOU)
Location: Houston, TX; AMF1 (main site for TRACER) (Lat: 29.67, Long: -95.059)

Facility Code: M1

Category: Surface Meteorology

Data Type: Routine Data ?

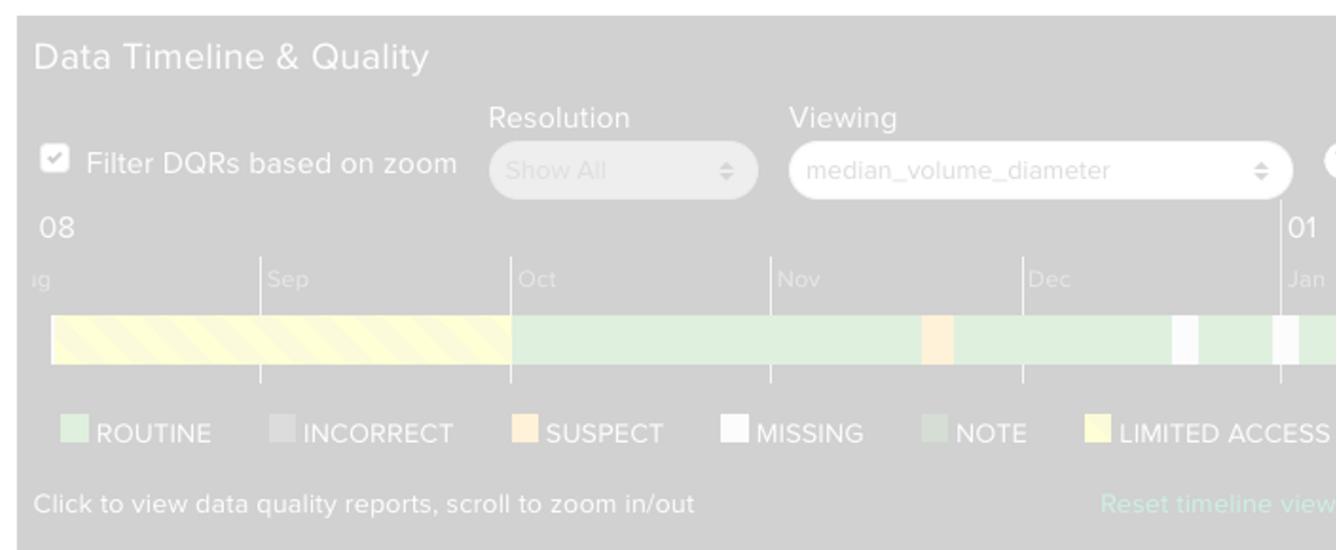
Source Instrument/Data: Video Disdrometer

Sampling Interval: 1 minute

Start Date: 2021-08-07

End Date: 2022-01-09 ?

DOI: 10.5439/1025315



Data Plots



Primary Measurements

File Header Information

Abundant details in this view includes: Data timeline & quality by variable and data plots; PMTs and ability to preview the file header



https://adc.arm.gov/discovery/#/results/id::houvdisM1.b1_median_volume_diameter_micro_vdis_sfcmet?dataLevel=b1&showDetails=true

VDIS

Selected data level

b1 Start: 2021-08-07
End: 2022-01-09

b1: QC checks applied to measurements

Description: Video Disdrometer Drop Size Distribution

Site: Houston, TX; Tracking Aerosol

Convection interactions ExpeRiment (HOU)

Location: Houston, TX; AMF1 (main site for TRACER) (Lat: 29.67, Long: -95.059)

Facility Code: M1

Category: Surface Meteorology

Data Type: Routine Data

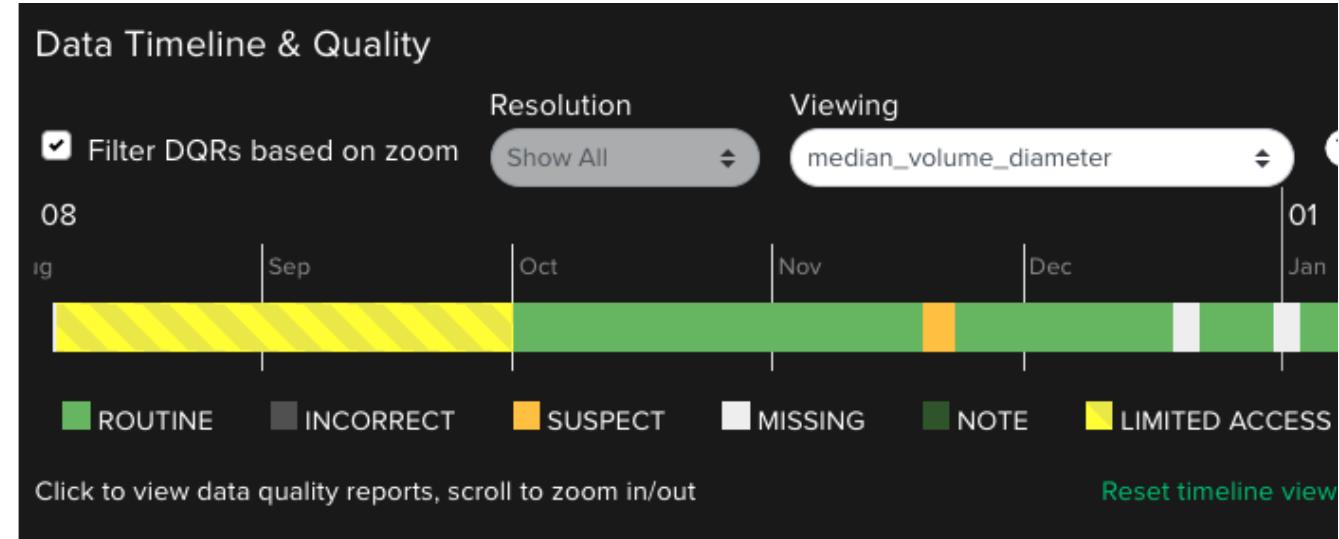
Source Instrument/Data: Video Disdrometer

Sampling Interval: 1 minute

Start Date: 2021-08-07

End Date: 2022-01-09

DOI: 10.5439/1025315



Data Plots



Primary Measurements

File Header Information

Abundant details in this view can also include a download of the file header, more info on recommended variables



https://adc.arm.gov/discovery/#/results/id::houvdisM1.b1_median_volume_diameter_micro_vdis_sfcmet?dataLevel=b1&showDetails=true

Primary Measurements

File Header Information

Data subsetting for the below variables is available.

VARIABLES:

Hydrometeor Size Distribution:

Variable: Number density (num_density)

Recommended

Precipitation:

Variable: Rain amount (rain_amount)

Recommended

Hydrometeor size:

Variable: Median volume diameter, assuming an ideal Marshall-Palmer type distribution (median_volume_diameter)

```
netcdf houvdisM1.b1.20220109.000000 {  
dimensions:  
    time = UNLIMITED ; // (1440 currently)  
    drop_diameter = 50 ;  
variables:  
    int base_time ;  
    base_time:string = "2022-01-09 00:00:00 0:00" ;  
    base_time:long_name = "Base time in Epoch" ;  
    base_time:units = "seconds since 1970-1-1 0:00:00 0:00" ;  
    double time_offset(time) ;  
    time_offset:long_name = "Time offset from base_time" ;  
    time_offset:units = "seconds since 2022-01-09 00:00:00 0:00" ;
```

Variable: Rain rate (rain_rate)

Recommended

Precipitation:

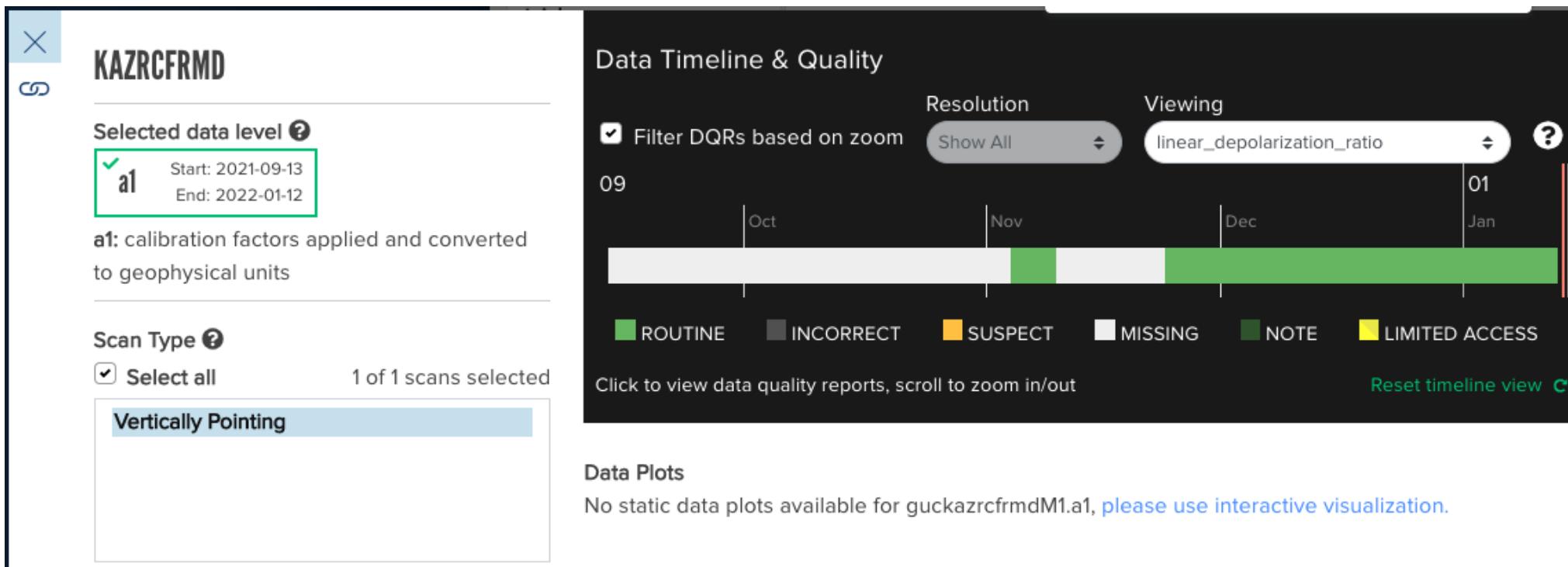
Variable: Sum of num_drops (total_drops)



Abundant details can also include a link to interactive visualizations when no plots exist, or when applicable type of radar scan



https://dq.arm.gov/dq-zoom/?ds=guckazrcfrmM1.a1&variable=linear_depolarization_ratio&sdate=20220112&edate=20220112&coordinate=

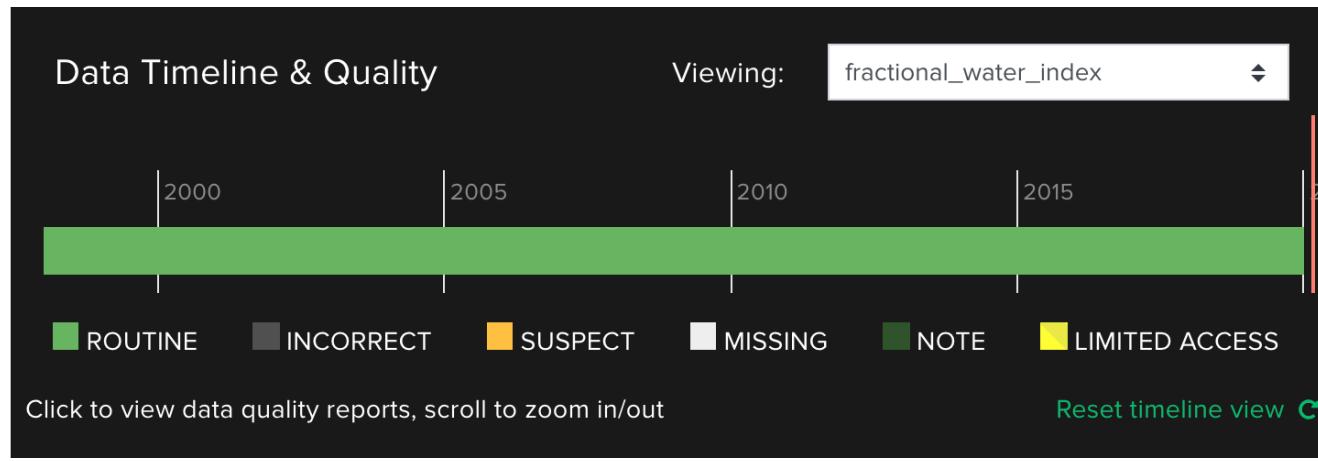


More on Data Quality: Reporting



Data Quality Reports (DQRs)—visible while browsing for data, received with data orders, and accessible through the DQR web service.

User contributions: “informing ARM of any issue”



Data quality issues can be found after data is made available
Must communicate this to users.

Now to actually order the data!

Add to Cart 



HOME



DATA SEARCH



SUPPORT



ACCOUNT
Login



CART

Checkout

To complete your request, you may refine your dates and then select the 'Checkout' button. You will be asked to login using your ARM account or you may set up an account. Your data will be entered into the processing queue and fulfilled within the next few hours. You will receive an email when your data request is complete, notifying you of the location of the FTP server for retrieval.

Source Instrument Data Types Discretometer

Date Range:

2021-08-07 to 2022-01-09

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

AUGUST 2021

01 Jan

CANCEL

Get timeline view 



New

HTML order confirmation emails now available

Data Discovery order confirmation emails are now available in HTML for all users. This is the standard plain text format. You may configure your email format preferences from the account page by clicking here.

Your Cart has 149 files and size ~ 190.63 MB

Update Date Range:

2021-08-07 to 2022-01-09



VDIS

Hydrometeor size

The size of a hydrometeor, measured directly or derived from other measurements.

Data Level: b1

Site: Houston, TX; Tracking Aerosol Convection interactions ExpeRiment (HOU)

Facility: Houston, TX; AMF1 (main site for TRACER) (M1)

Category: Surface Meteorology

Data Type: Routine Data 

Now simply check out, with method of delivery

ARM

Data Selection Summary



VDIS

Hydrometeor size

The size of a hydrometeor, measured directly or derived from other measurements.

Data Level: b1

Site: Houston, TX; Tracking Aerosol Convection interactions ExpeRiment (HOU)

Facility: Houston, TX; AMF1 (main site for TRACER) (M1)

Category: Surface Meteorology

Data Type: Routine Data

Source Instrument/Data: Video Disdrometer

Date Range:

2022-01-08

to 2022-01-09

[Add Another Date Range](#)

Order all Variables

Extract Requested Variables

Note: all variables will be delivered for this datastream.

Extraction options only apply when "Extract Requested Variables" is selected.

Citation Format: Select

2 files // 2.56 MB

Concatenate files by
variable

No

File format(s)

NetCDF ASCII-CSV

Filter data flagged by Data
Quality Reports

Incorrect Suspect

Data Delivery Options

All orders are provided via FTP

Globus

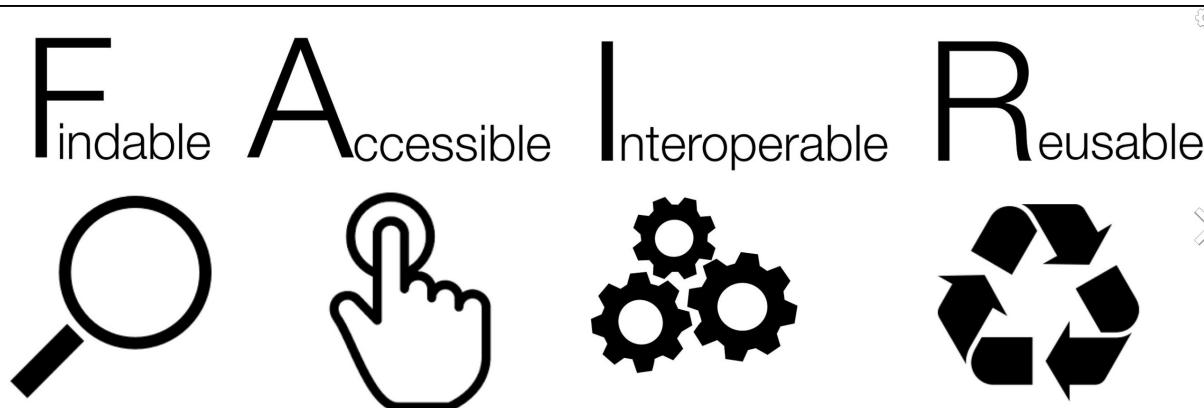
THREDDS

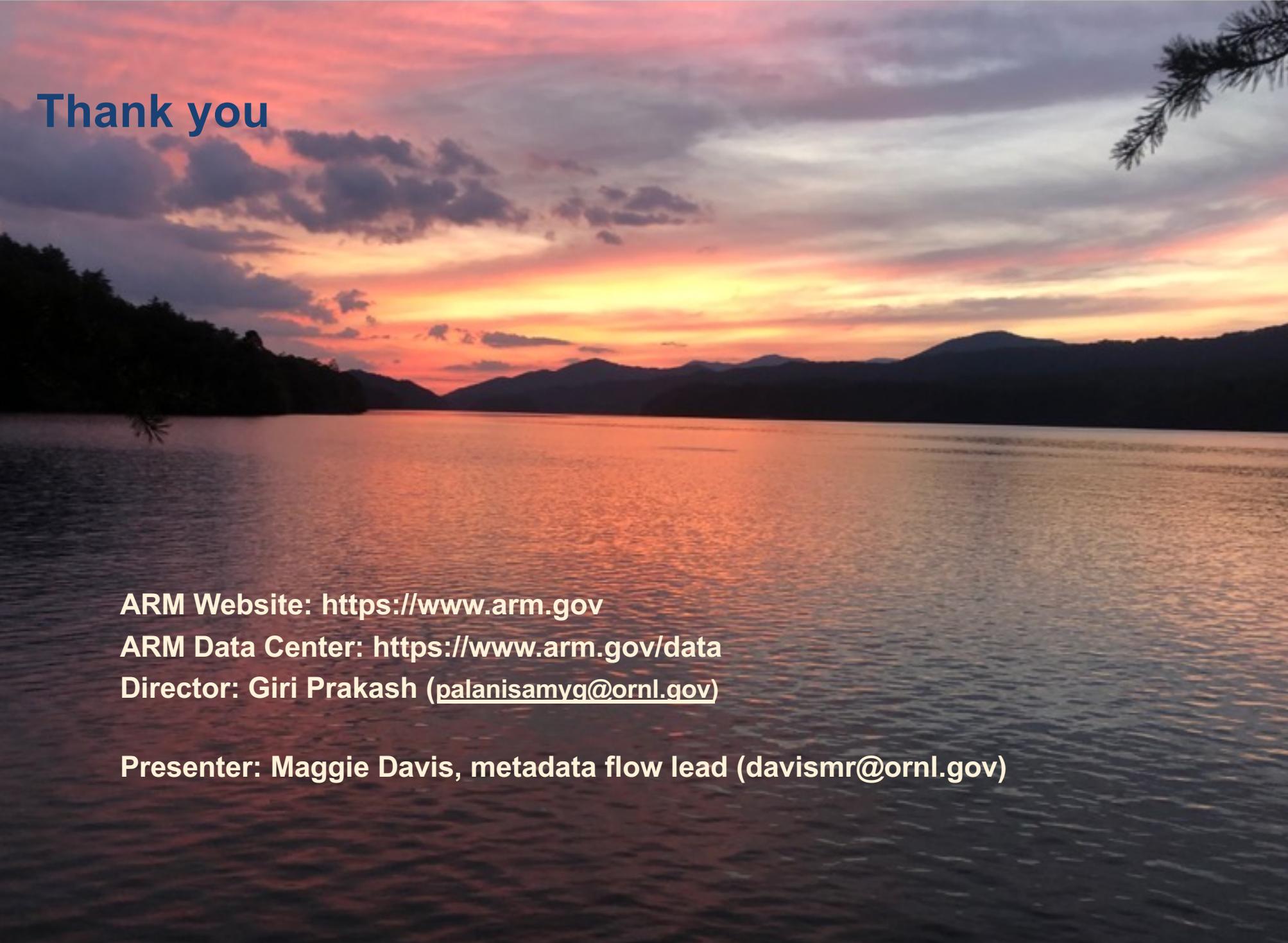
Dropbox

[Submit Data Request →](#)

Summary

- ▶ ARM facilitates easy discovery for users through an interactive portal and accompanying details pages
- ▶ Longevity of data relies on full metadata – promotes long term preservation,
- ▶ Enables data interoperability;
- ▶ Provides proper credit to data contributors





Thank you

ARM Website: <https://www.arm.gov>

ARM Data Center: <https://www.arm.gov/data>

Director: Giri Prakash (palanisamyq@ornl.gov)

Presenter: Maggie Davis, metadata flow lead (davismr@ornl.gov)