



Data as an Ecosystem at ARM User Facilities

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<https://www.arm.gov>

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Atmospheric Radiation Measurement (ARM) Facility

MISSION:

Provide the climate research community with strategically located atmospheric observatories to improve the understanding and representation in earth system models of clouds and aerosols and their interactions with the Earth's surface.



The World's Foremost Ground-Based Atmospheric Observing Facility



Atmospheric Radiation Measurement Facility

Since 1992, the world-leading facility for measurements of cloud & aerosol properties, & their impacts on Earth's energy balance

Network of 3 fixed-location & 3 mobile observatories

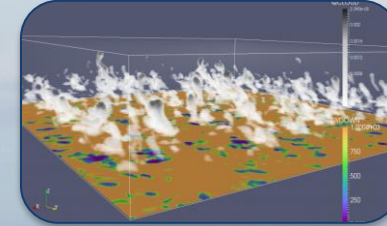
Piloted & unmanned aerial measurement platforms

Extensive data management infrastructure

Freely available data products to support atmospheric research & model development

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

Comprehensive measurements across diverse climate regimes



Serves the international climate research community and has close collaboration with Atmospheric System Research (ASR)

Source: Jim Mather



Comprehensive Sets of Measurements Deployed in Diverse Climate Regimes



Background
atmospheric state



Surface energy
balance



Aerosol and
hydrometeor profiles



Near-surface
aerosol properties

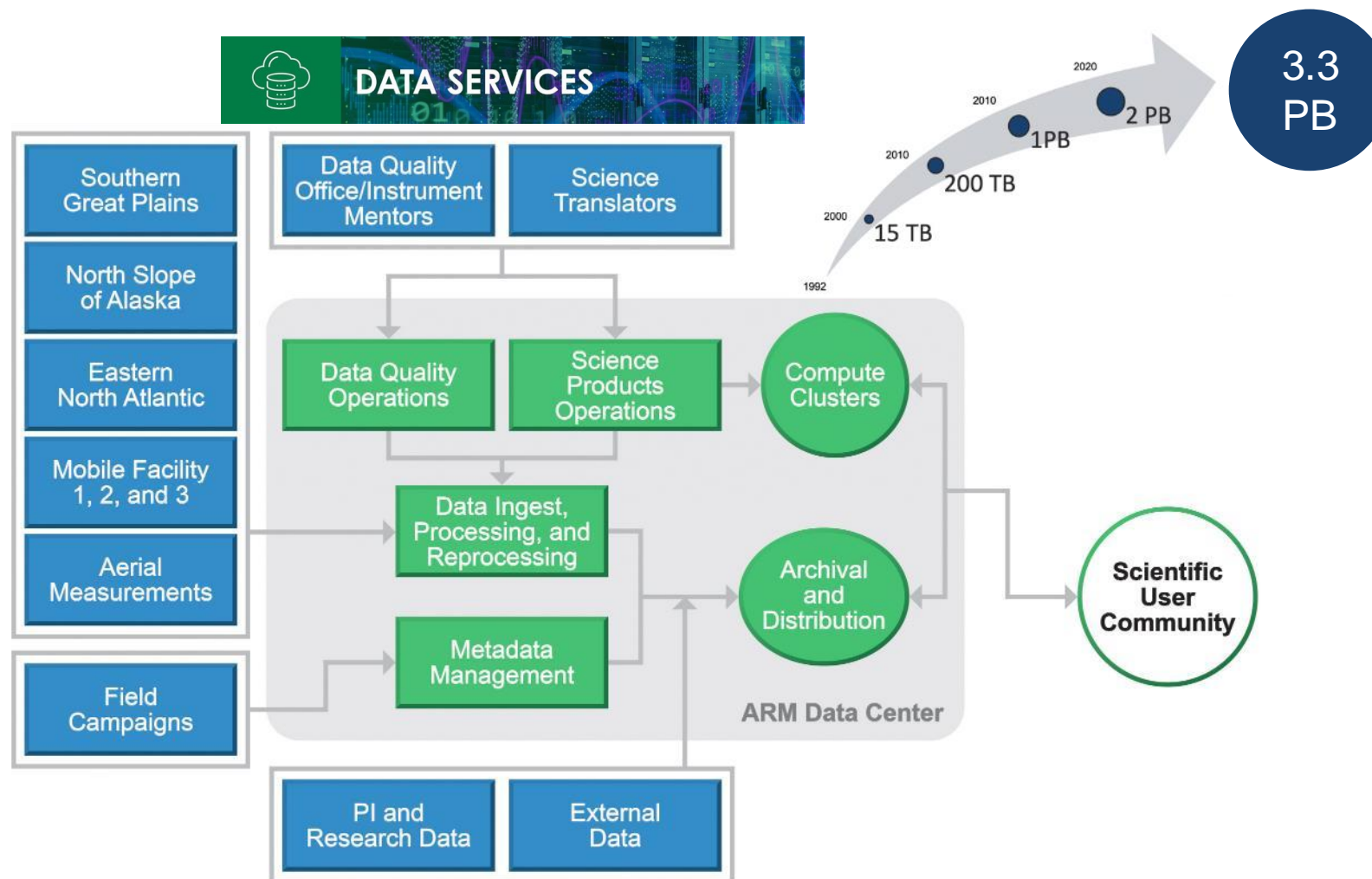


Aerial
measurements

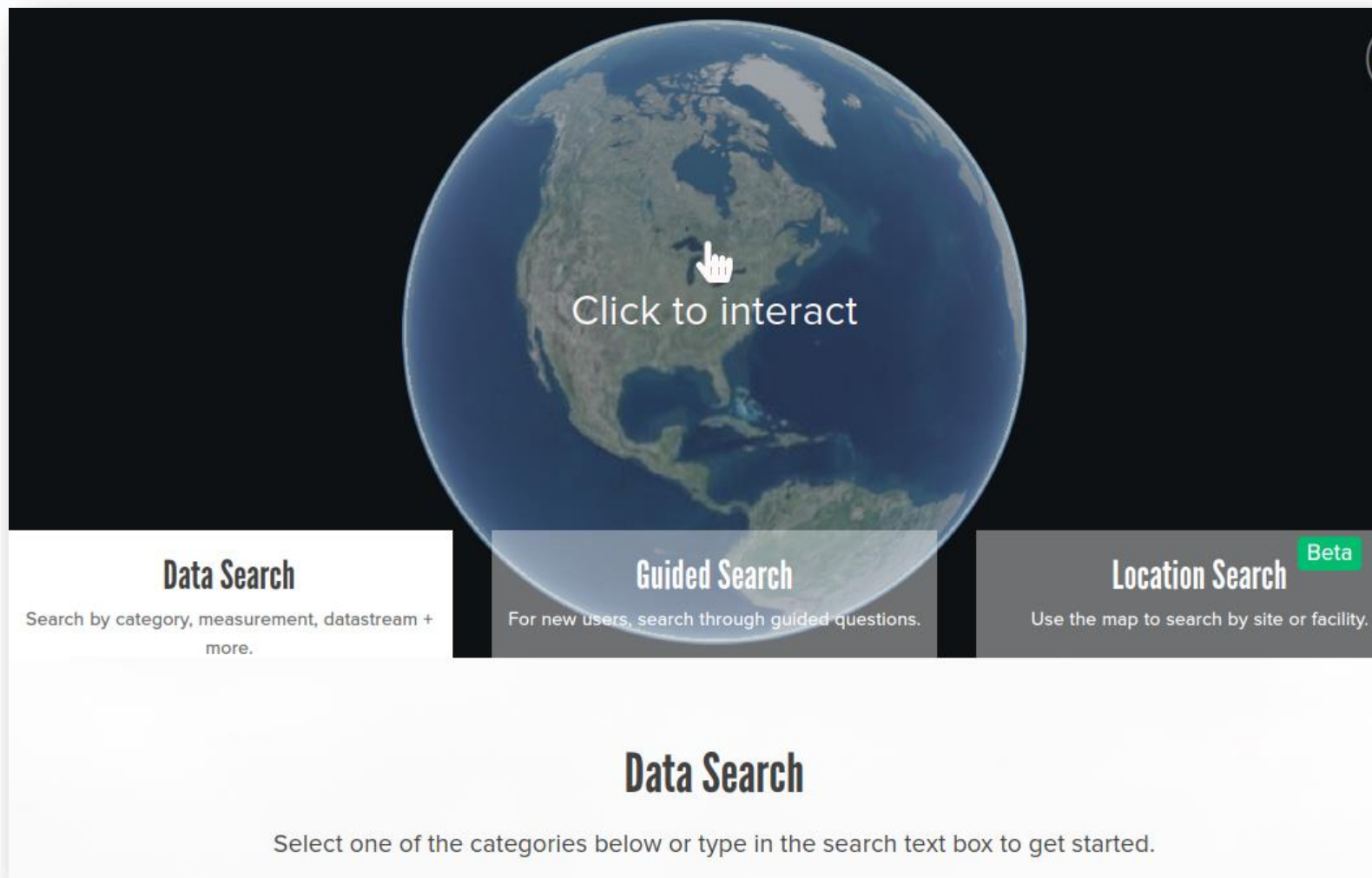


End-to-End Data Services

Providing powerful and adaptable computing resources to meet data analysis challenges



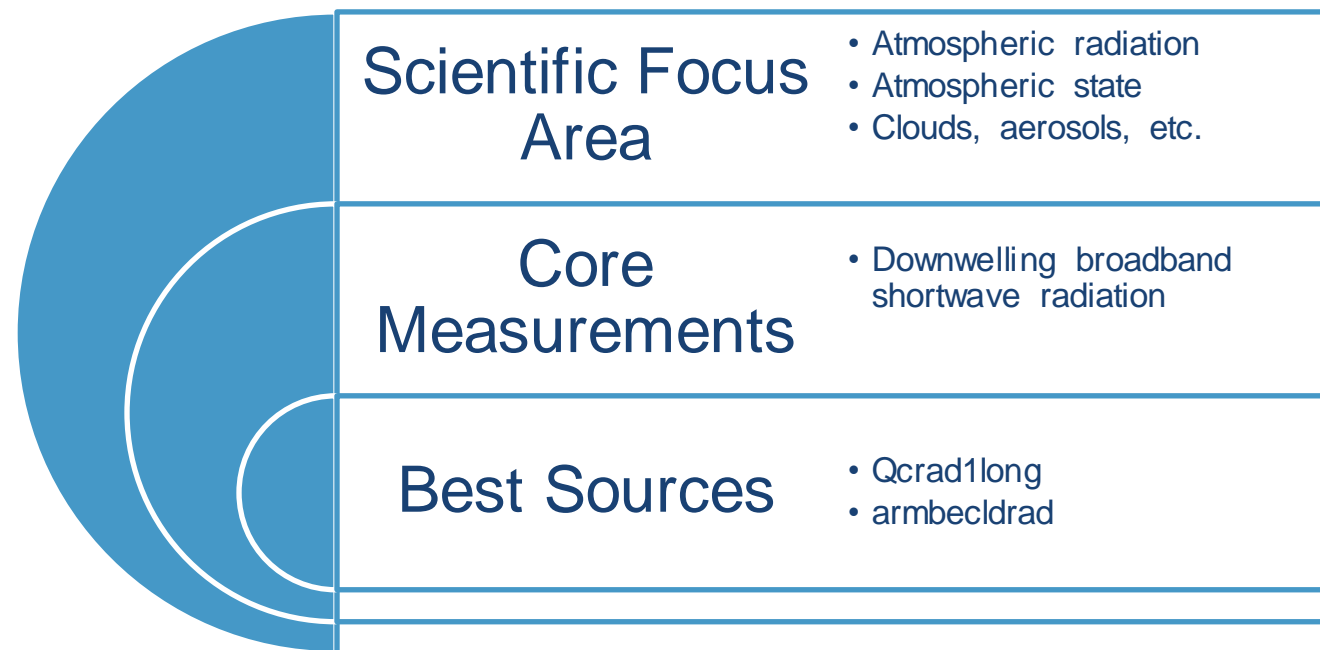
Data Recommender System – A solution for Data Discovery



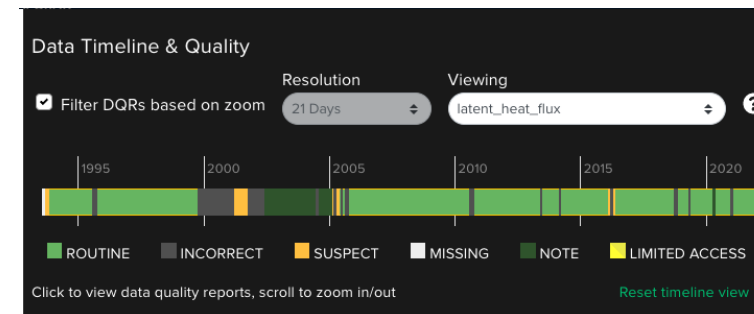
Data Recommender System – A solution for Data Discovery Challenge



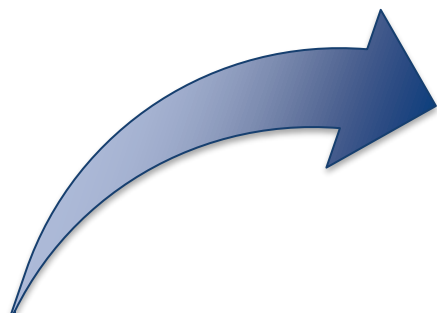
- Recommends best data sources for the core measurements
- Criteria for recommendations include:
 - Quality
 - Temporal and spatial coverage and resolution
 - Applicability for the research needs
- Process include input from subject matter experts



Pls: Maggie Davis (ORNL) & Scott Collis (ANL)



Data Recommender System – A solution for Data Discovery



Guided Search

For new users, search through guided questions.

Use the map to

Where do you want to begin your search?

☒ Measurement
 If you are interested in a specific measurement (variable) obtained by instruments or derived by models? E.g., vapor_pressure, pressure, temperature

☐ Instrument
 If you are interested in a single piece of hardware or group of sensors hardware that records one or more measurements? E.g., a tipping rain bucket.

☐ Characteristics
 If you are interested in certain attributes of the landscape or environment in which the data were collected? E.g., hilly, or raining

☐ Epoch Alpha
 If you are interested in a datastream or multiple datastreams at a single location with well characterized data quality, corrections and calibrations applied, over a specified time range of scientific interest?

Next Step →

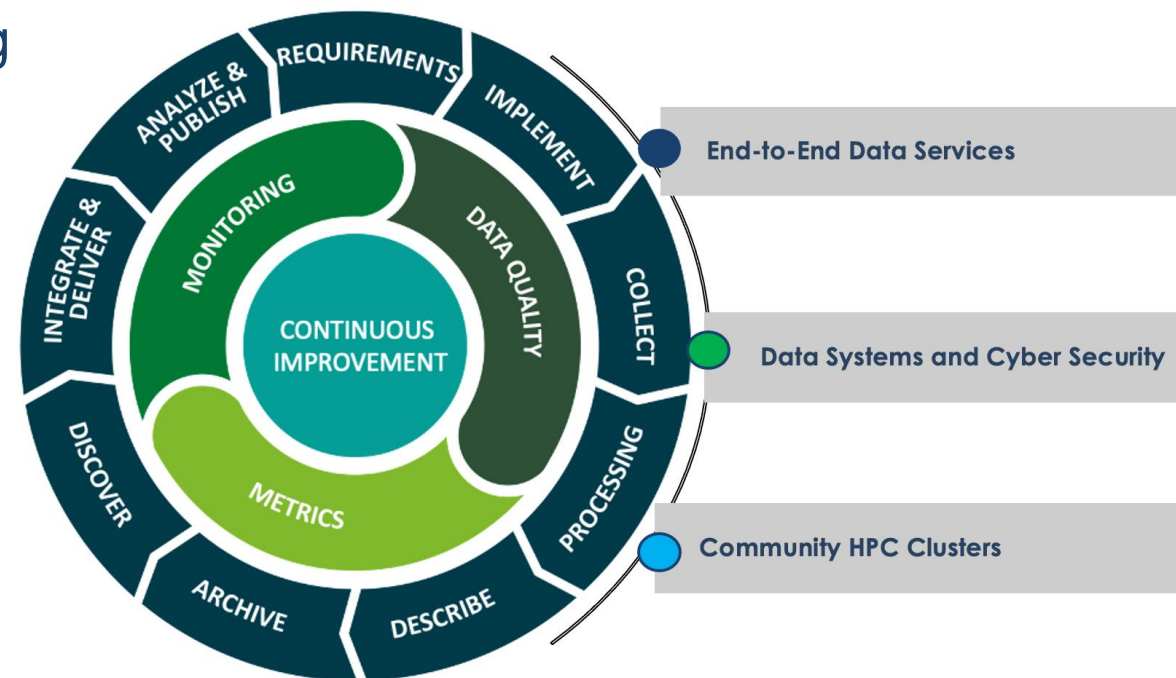
← New Guided Search

Searching For: Measurement

Measurement Category	1. WHAT CATEGORY OF MEASUREMENT?		Measurement Sub-Category	Primary Measurement	Data Level	Location	Dates
	<input type="radio"/> Aerosols	Active and passive remote sensing instruments are used to measure the macroscopic properties (horizontal and vertical distributions) of clouds,					
	<input type="radio"/> Atmospheric Carbon	and the microphysical properties (sizes, shapes, and phases [water or ice]) of the particles that comprise the clouds.					
	<input type="radio"/> Atmospheric State						
	<input checked="" type="radio"/> Cloud Properties						

ARM & the Data Lifecycle

- ▶ Provides a robust integrated data and computing ecosystem to advance understanding of atmospheric radiation
- ▶ Key components include:
 - Data management, operations, and monitoring
 - Data archive and distribution
 - Cyberinfrastructure
 - High-performance computing (HPC) environment
 - User metrics
 - Data analytics and visualization

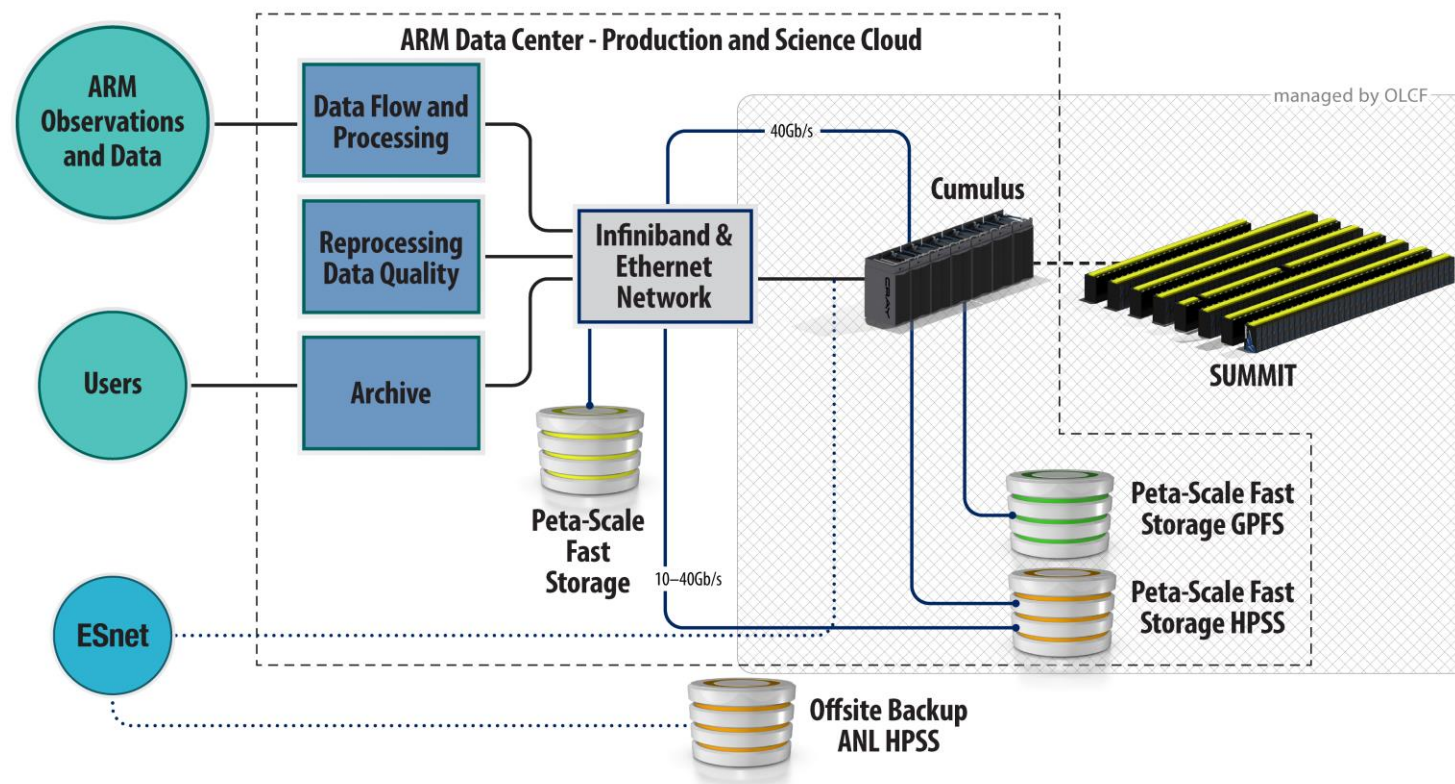


Next-Gen Data and Computing Infrastructure

► Leveraging DOE Leadership Computing and commercial Cloud Capabilities

<https://www.arm.gov/capabilities/computing-resources>

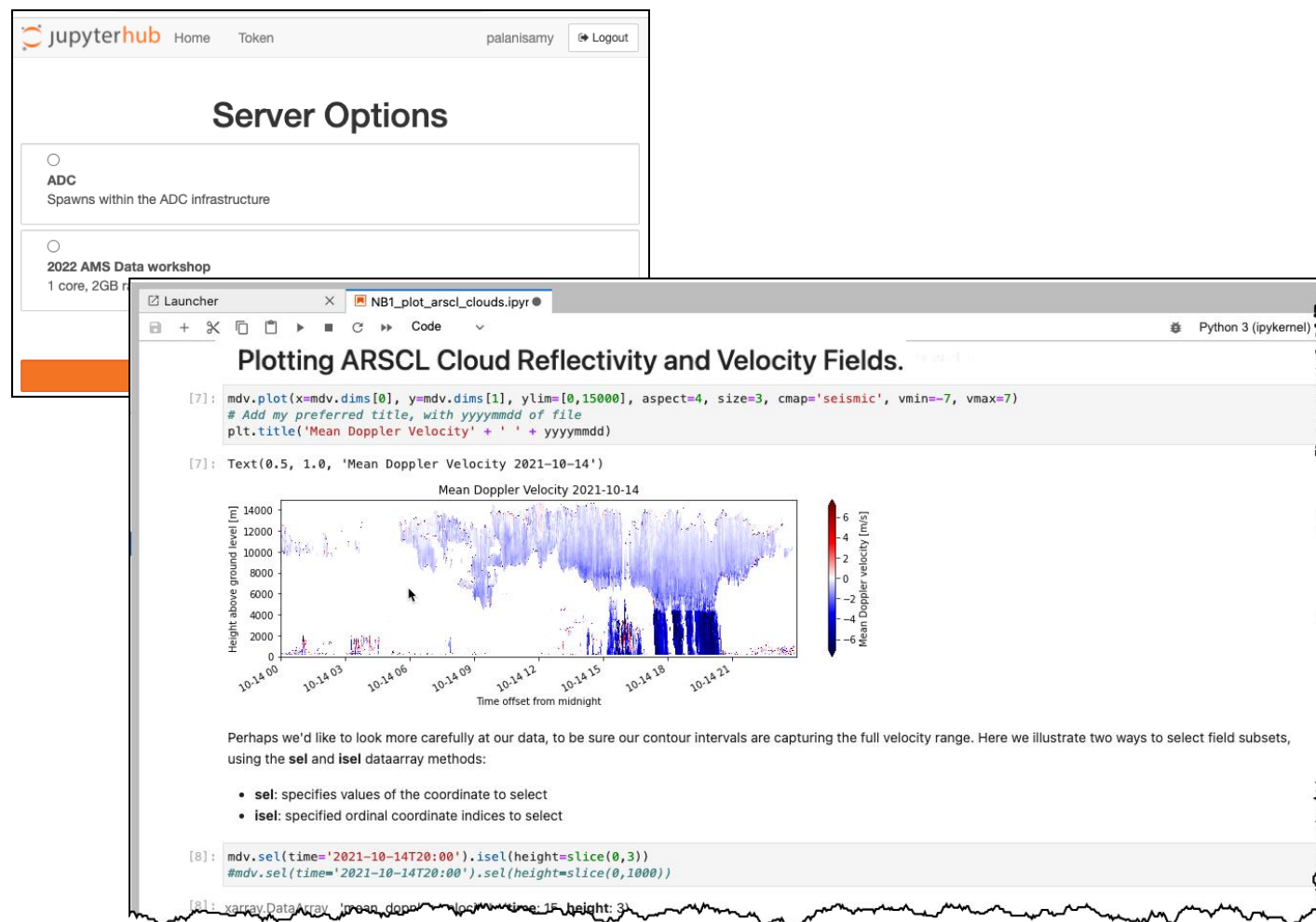
Offers computing infrastructure to support next-generation ARM model simulations, petascale data storage, and big-data analytics for atmospheric and climate science research.



Enabling Data Analytics

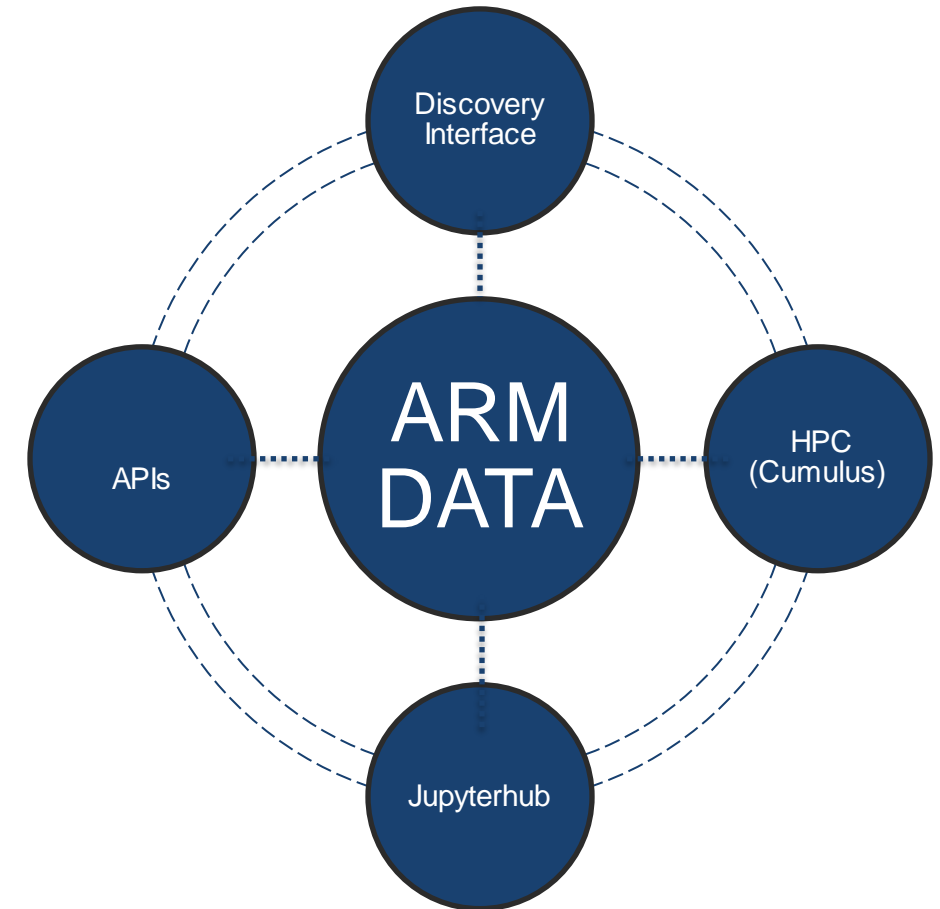


- Highly scalable Jupyterhub deployment to Kubernetes cluster.
- Access to All ARM Data
- Spawn data analytics and processing to ARM HPC
- Trainings and tutorials

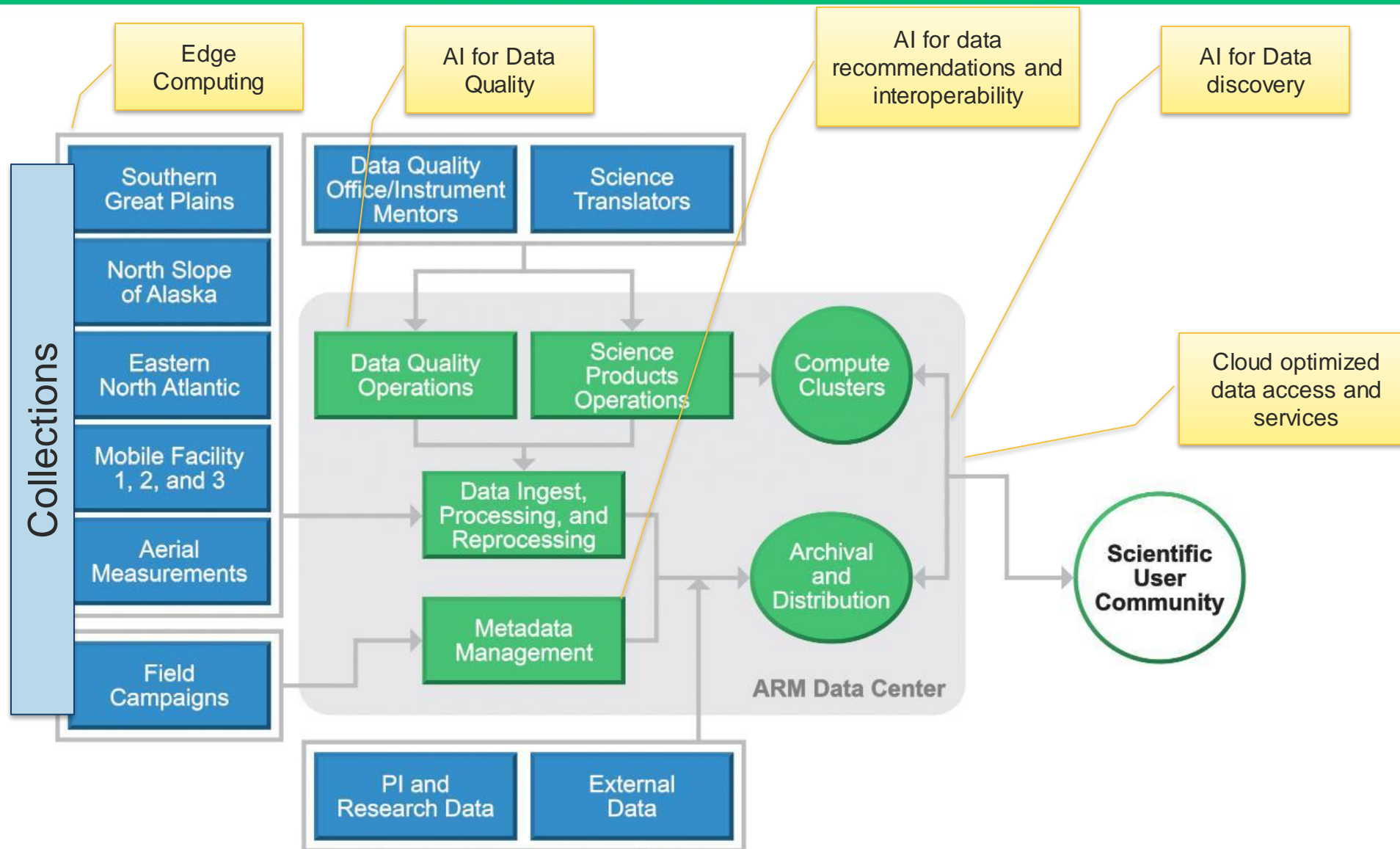


Zach Price (ADC)

- ▶ Direct mount of data archives to Jupyterhub in ADC Infrastructure.
- ▶ Globus transfers from Discovery Interface.
- ▶ API's for data retrieval to HPC and Jupyterhub.



Looking Ahead..



"Enable advanced data analytics and community use of complex ARM data sets through the advancement of computing infrastructure and data analysis."

Atmospheric Radiation Measurement User Facility: Decadal Vision
DOE/SC-ARM-20-014

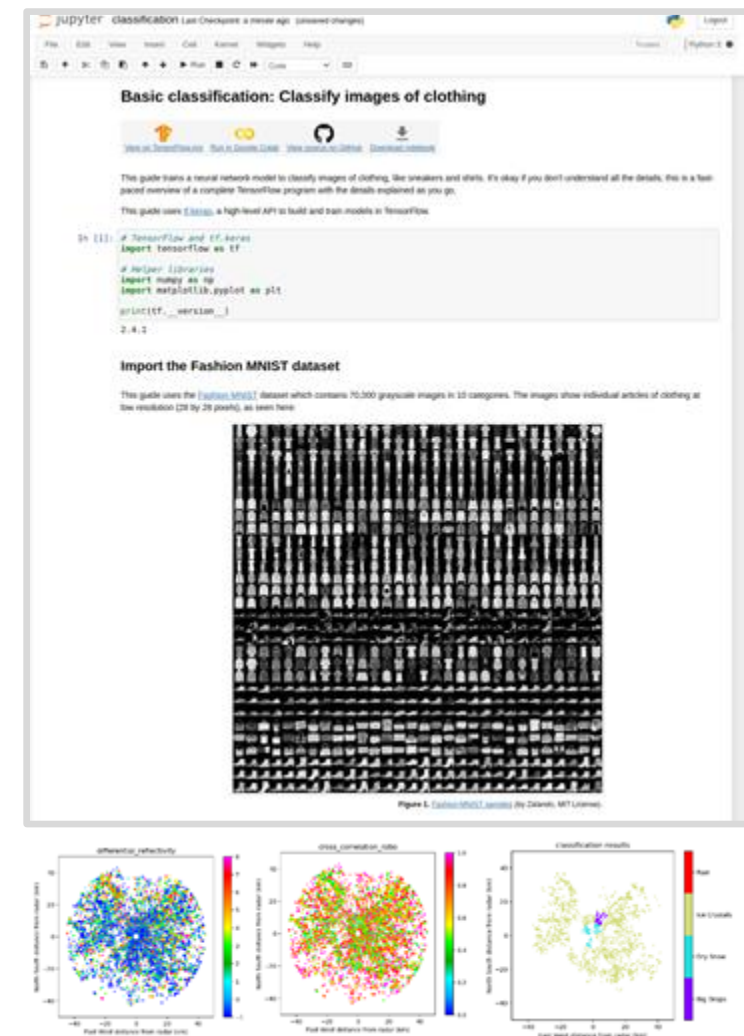
Lower the barrier to entrance for using ARM data.

- Library of off-the-shelf data analytics, algorithms, and visualizations
- Easy access to tutorials and guides.



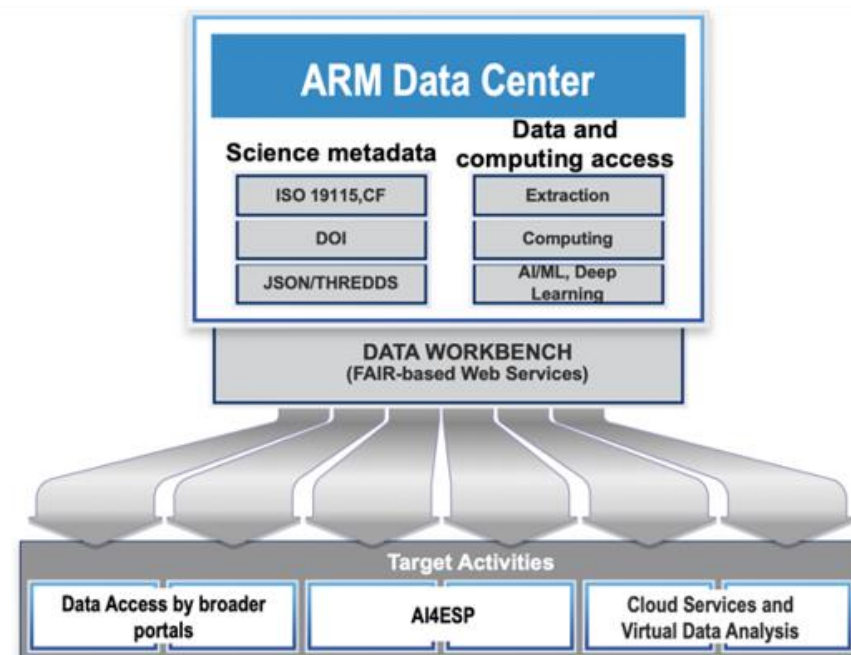
Widen the Impact of ARM Data

- Less restrictive authorization requirements for using Data Workbench opens up using data to a wider audience.
- Training for the next generation of atmospheric scientists.



New Features and Capabilities






- Build custom datasets based on metadata facets.
- Merge datasets (“custom VAPs”).
- Integration with archival options for derivative datasets that are created
- Seamless integration with Jupyterhub and HPC.



Questions?



- ▶ <https://www.arm.gov>
- ▶ "Ask Us"
- ▶ ARM Data Center: adc@arm.gov
- ▶ My contact: ihlimi@ornl.gov

ATMOSPHERIC RADIATION MEASUREMENT USER FACILITY				
CONNECT WITH ARM	POLICIES	HELP	RESOURCES	WORKING WITH ARM
CREATE ACCOUNT	DATA POLICIES	ASK US	MEDIA	USE ARM FACILITIES
ORGANIZATION	CAMPAIGN GUIDELINES	ASK A UEC MEMBER	OUTREACH	ACKNOWLEDGE ARM
    	LINKING POLICIES	DATA QUESTIONS	ACRONYMS	SUBMIT A PROPOSAL
Reviewed September 2021	PRIVACY & SECURITY NOTICE	FAQS	GLOSSARY	FIND EMPLOYMENT
	DIVERSITY, EQUITY, & INCLUSION	ACCOUNT MANAGEMENT		VIEW ARM PRIORITIES
	VULNERABILITY DISCLOSURE PROGRAM			