ARM

CLIMATE RESEARCH FACILITY

ARM Orientation for New and Current Principal Investigators

Second ASR Science Team Meeting
San Antonio, Texas
March 28, 2011

U.S. DEPARTMENT OF ENERGY | Office of Science

Outline

- ARM Overview
- How to:
    - Find a datastream
    - Order a datastream
    - Read a NetCDF file
    - Review data quality information
    - Submit a research highlight or publication
    - Submit an field campaign request
    - Find out what's going on around the program
    - Submit a general question or comment

DOE Climate Change Science Goals

From the 2009 BER Climate Change Research Program (CCRP) Strategic Plan:

The two high-priority questions that focus the BER CCRP are:

1. *When, where, and by how much will climate be affected by increasing greenhouse gas concentrations in the atmosphere?*
2. *What are the likely consequences of climate change for ecosystems, the energy system, and other important human and natural systems?*

http://www.er.doe.gov/ober/ober_top.html

Resolving the Most Critical Uncertainties of Climate Change

- The three high-priority science questions that summarize this critically needed research are:

1. *What are the present deficiencies in cloud formulations and cloud feedback representations in climate models, and how can they be eliminated?*

2. *What are the climatically relevant chemical and physical properties of aerosols that control their effects on the atmosphere's radiation balance, and how can they be best represented in climate models?*

3. *What are the present deficiencies in terrestrial carbon cycle feedback representations in climate models, and how can they be eliminated?*

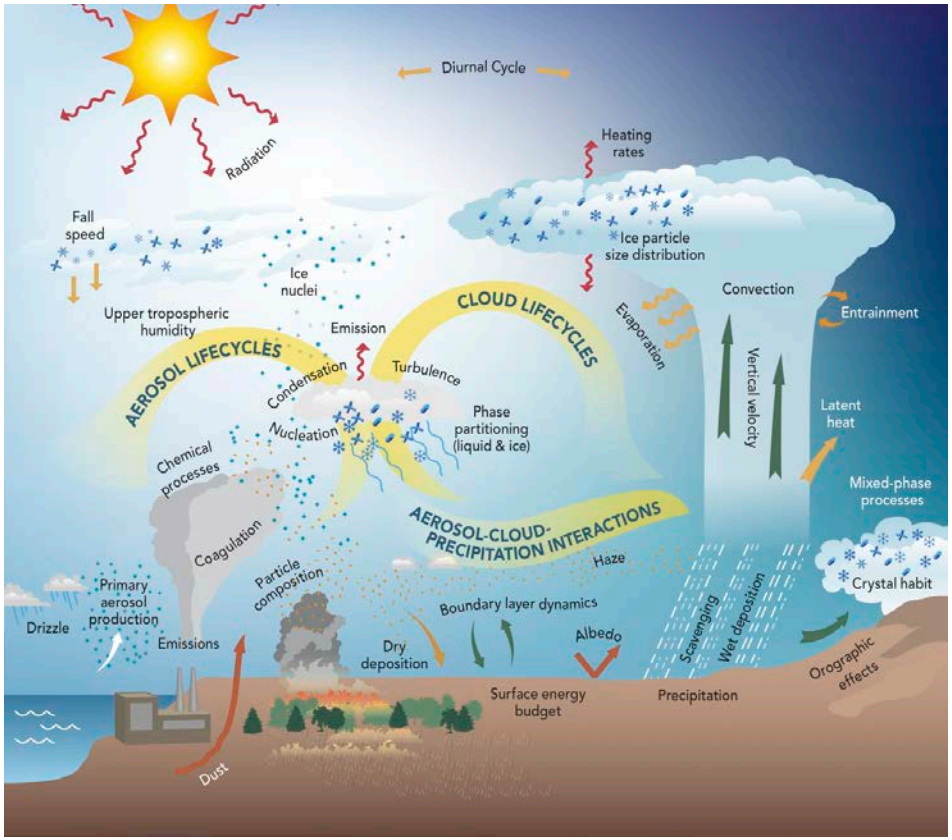
ASR and ARM

ARM: The Atmospheric Radiation Measurement Climate Research user facility collects and delivers observational data for the general climate research community.

ASR: The Atmospheric System Research program conducts climate research based on observations conducted with the ARM facility.

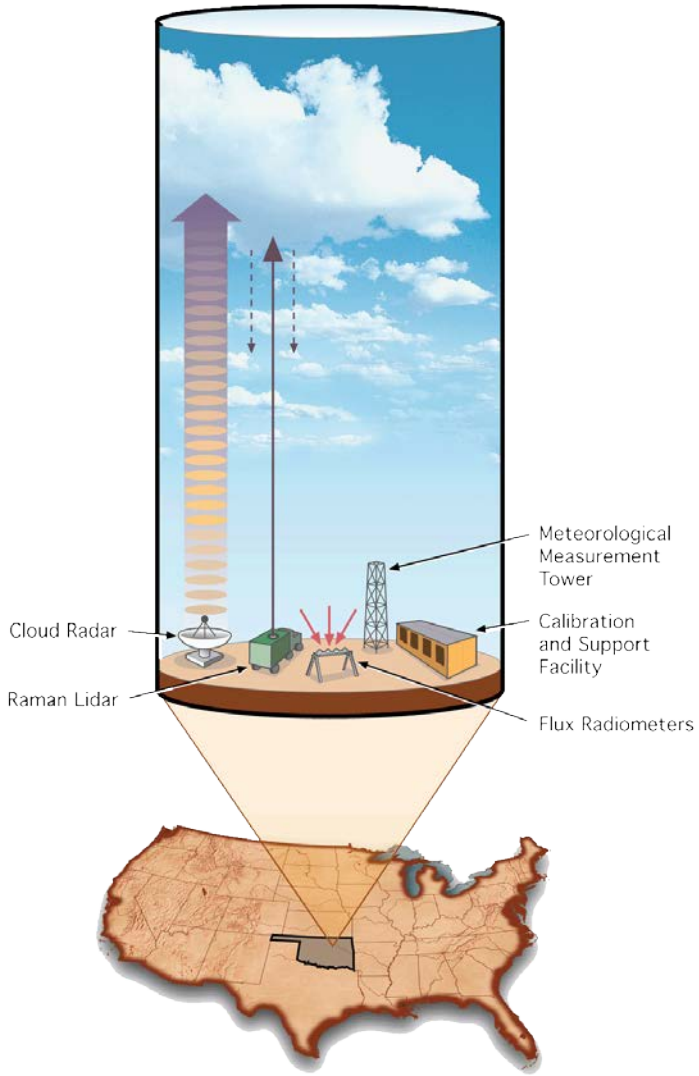
Atmospheric System Research (ASR) Mission Statement

The goal of ASR, in partnership with the ARM Facility, is to quantify the *interactions among aerosols, clouds, precipitation, radiation, dynamics, and thermodynamics* to improve fundamental **process-level understanding**, with the ultimate goal to reduce the uncertainty in global and regional climate simulations and projections.



ARM Goals and Objectives

- Provide the national and international scientific community with the infrastructure needed for scientific research on global change
- Global change research includes the study of alterations to climate, land productivity, oceans, water cycle, atmospheric chemistry, and ecological systems



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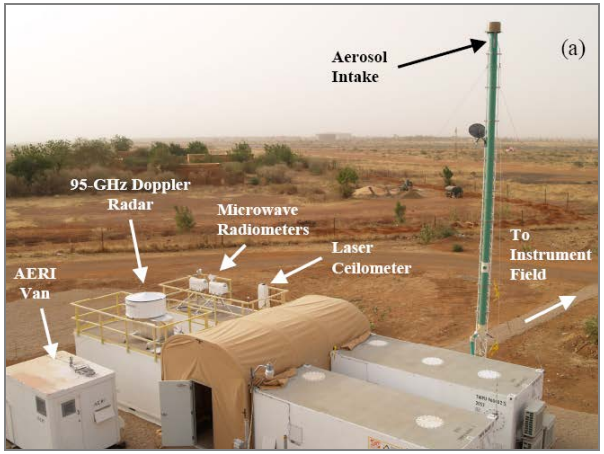
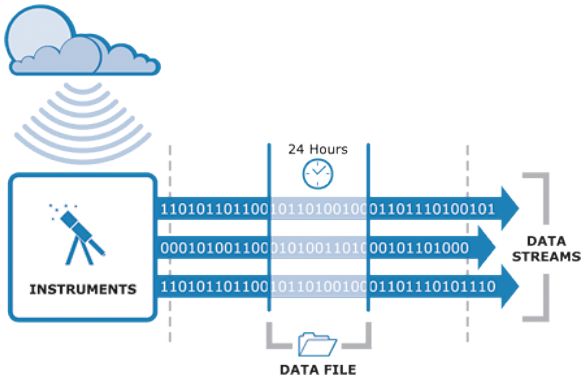
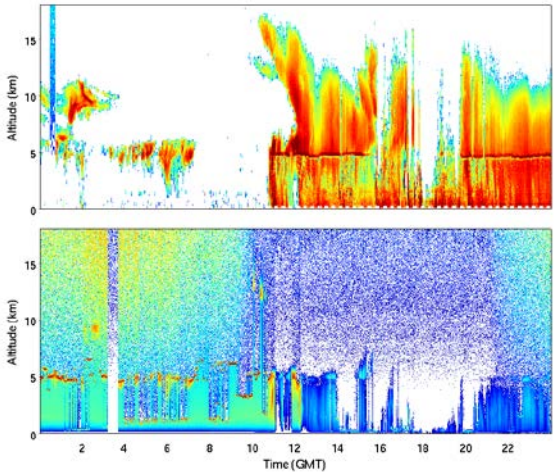
Overview: Facility Components

- Research sites – permanent, mobile, and aerial
- Instruments and measurements
- Data processing, data quality, Data Archive
- Field campaigns – ground-based and airborne







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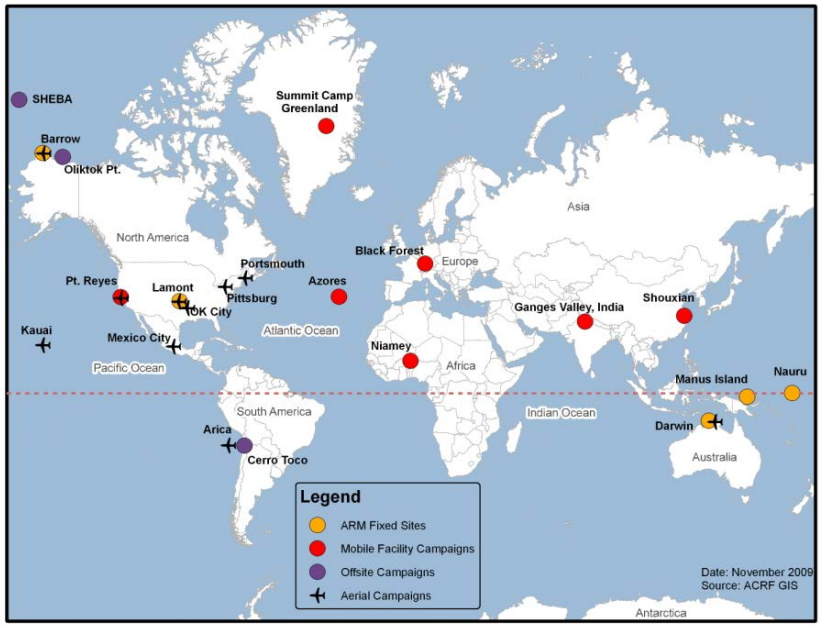
Overview: Research Sites



- Southern Great Plains (1993)
- North Slope of Alaska: Barrow (1998) and Atqasuk (1999)
- Tropical Western Pacific: Manus (1996), Nauru (1998), and Darwin (2002)
- First ARM Mobile Facility (2005); Second ARM Mobile Facility (2010)
- ARM Aerial Facility (2007)

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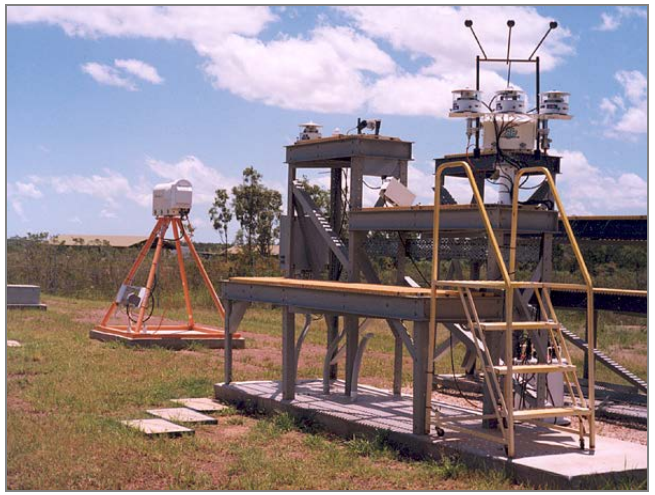
Overview: Measurements and Instruments

- Cloud profiles: millimeter radar and lidar
- Temperature/relative humidity/wind profiles: radiosondes
- Column water: microwave radiometer
- Column aerosol: solar spectral radiometer
- In situ aerosol optical and cloud nucleation properties
- Surface radiation budget: solar and terrestrial IR radiometers
- Surface meteorology: T/RH/wind

Additional instruments being deployed through the Recovery Act



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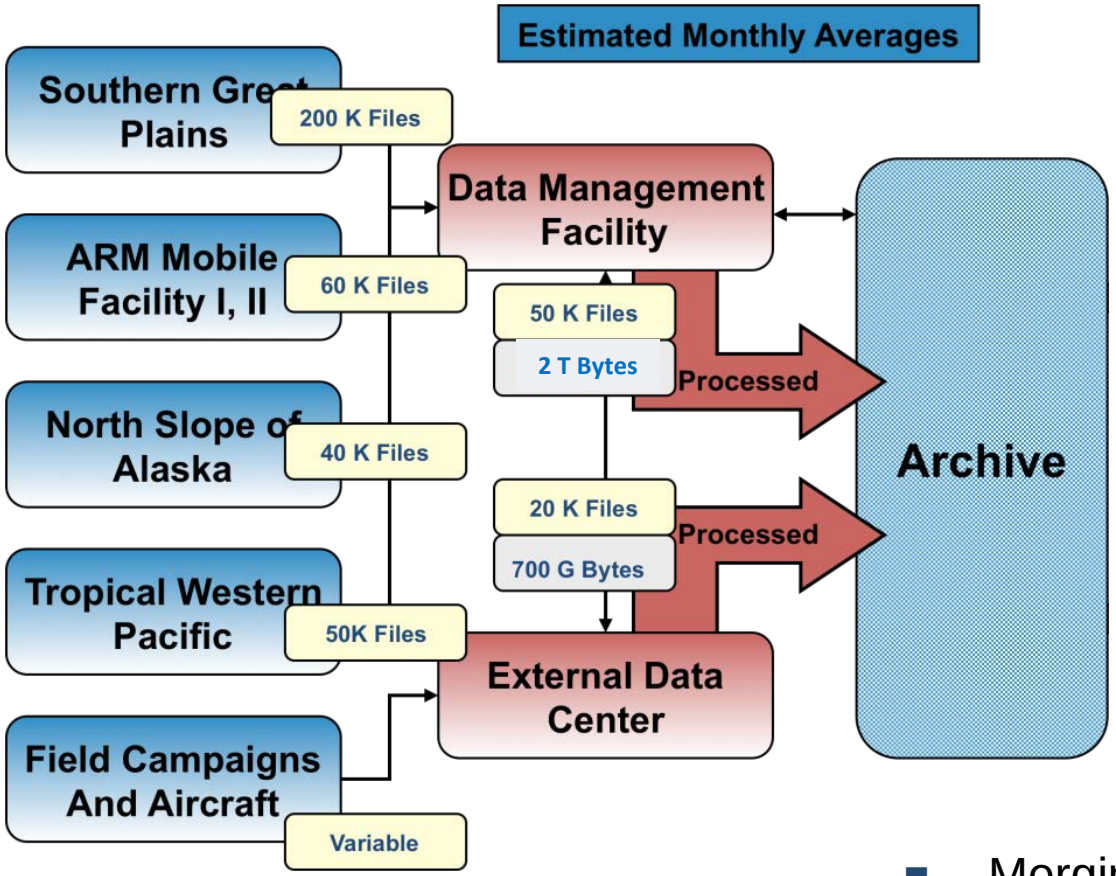
Overview: Data Products



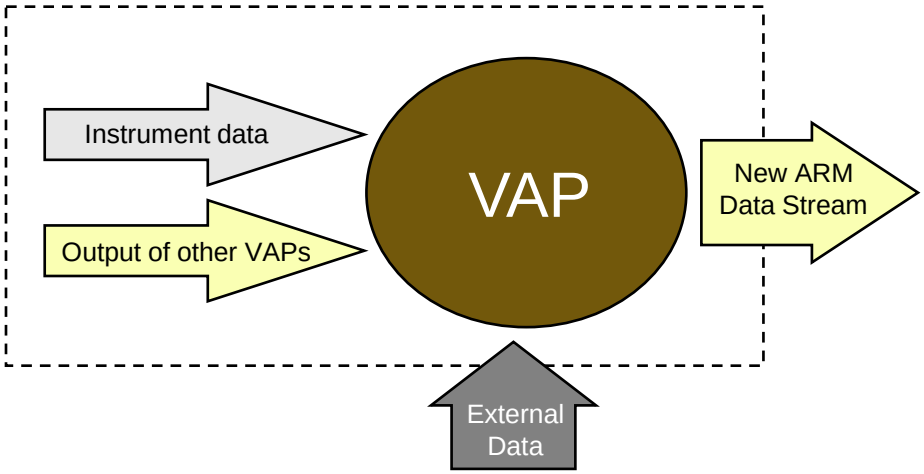
Most instrument data are processed to a standard NetCDF format before being delivered to the Archive.

When necessary, higher-order Value-Added Products (VAPs) are developed. VAPs serve a variety of purposes including:

- Merging data from multiple instruments
- Providing derived parameters
- Adding QC/QA information

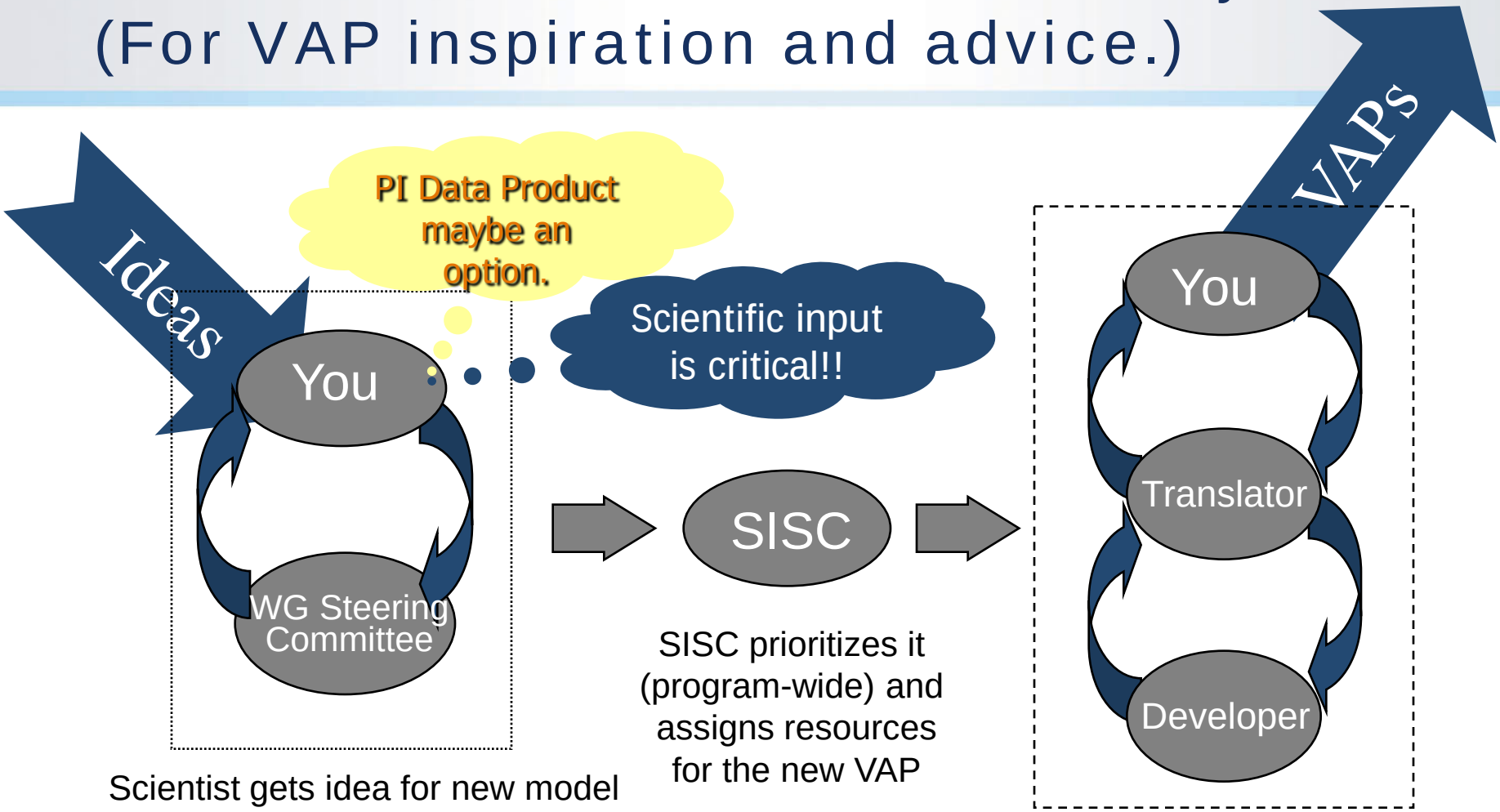
More on VAPS...

- VAPs are products from automated analytical procedures (models, retrievals, etc.) that are run in the ARM data system
- Inputs come from instruments, other VAPs, and/or external data
- Output is a new ARM data stream



ARM wants your input. Please note *"Procedure for Submitting Science and Research Products to the Data Archive"* at:
http://www.arm.gov/data/docs/procedure

Still more on VAPS… ARM needs you! (For VAP inspiration and advice.)



Scientist gets idea for new model or algorithm and presents it to the WG. The WGSC prioritizes the idea and contacts the SISC

SISC prioritizes it (program-wide) and assigns resources for the new VAP

Translator works with the Scientist to further define the algorithm, and then interacts with the Developer to implement the VAP. Translator and the Scientist then evaluate and document.

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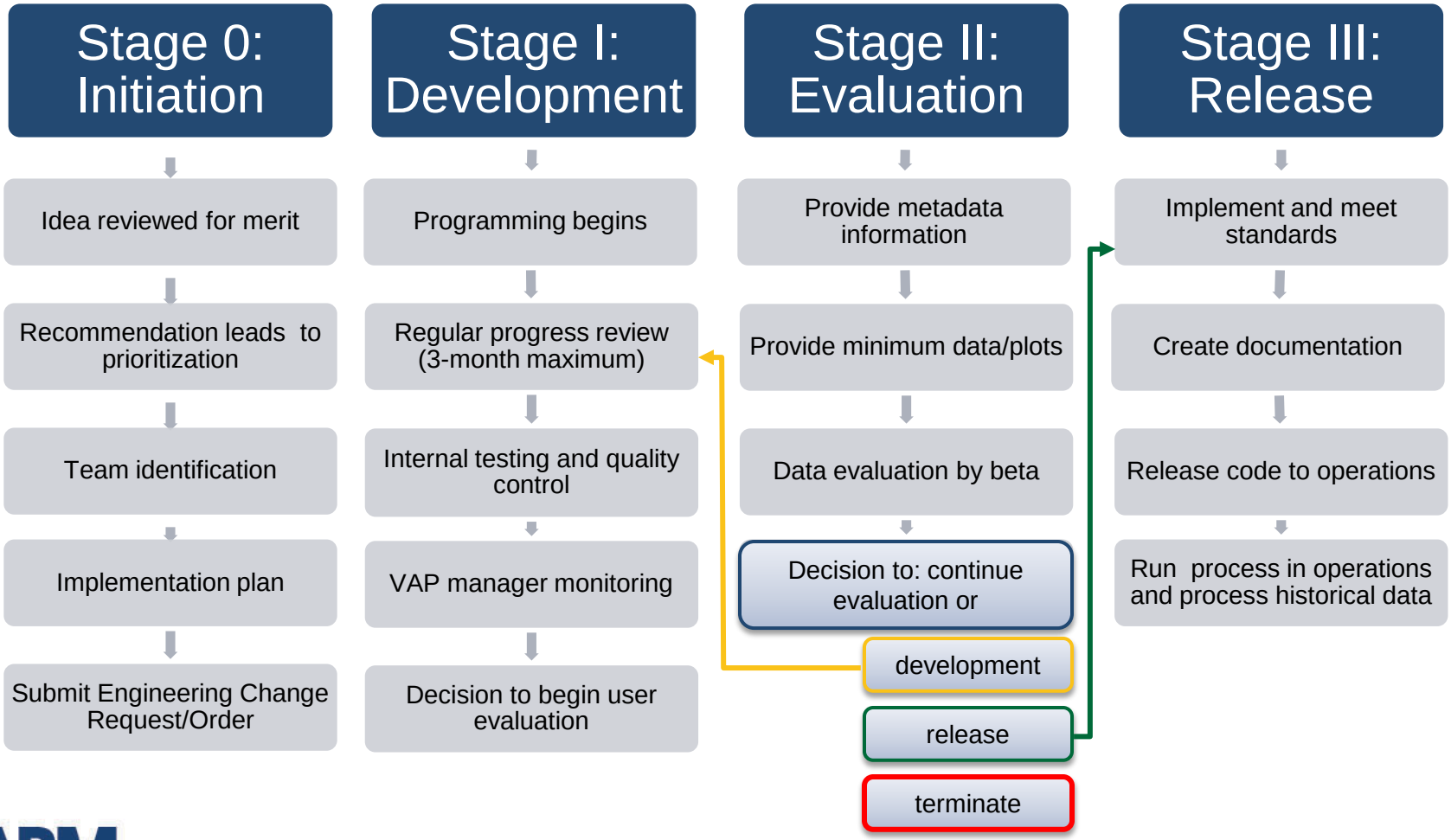
Value Added Product Stages



Key Contacts for New Datastreams

Working Group Chairs

- Cloud lifecycle: Matthew Shupe, Anthony Del Genio
- Aerosol lifecycle: Allison McComiskey, Jian Wang
- CAPI: Dave Turner, Steve Ghan

Translators

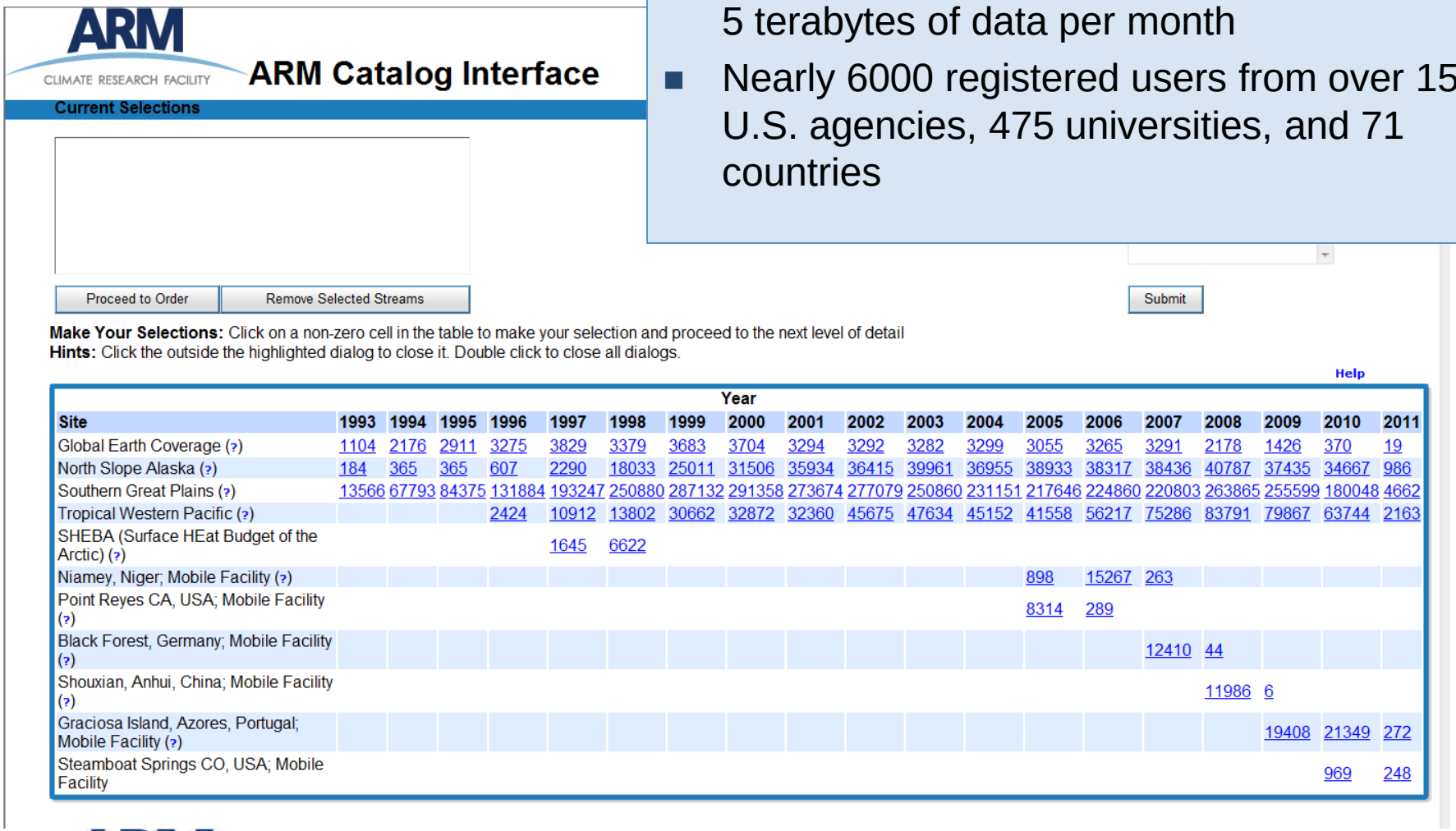
- Observation: Mike Jensen, Connor Flynn, Sally McFarlane
- Modeling: Shaocheng Xie, Jerome Fast

Program Contacts: http://www.arm.gov/about/contacts

People Database: http://www.arm.gov/people

Overview: Data Archive

- The Data Archive collects and delivers about 5 terabytes of data per month
- Nearly 6000 registered users from over 15 U.S. agencies, 475 universities, and 71 countries



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ARM Catalog Interface

Current Selections

Proceed to Order | Remove Selected Streams | Submit

Make Your Selections: Click on a non-zero cell in the table to make your selection and proceed to the next level of detail
Hints: Click the outside the highlighted dialog to close it. Double click to close all dialogs.

Help

	Year																		
Site	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Global Earth Coverage (?)	1104	2176	2911	3275	3829	3379	3683	3704	3294	3292	3282	3299	3055	3265	3291	2178	1426	370	19
North Slope Alaska (?)	184	365	365	607	2290	18033	25011	31506	35934	36415	39961	36955	38933	38317	38436	40787	37435	34667	986
Southern Great Plains (?)	13566	67793	84375	131884	193247	250880	287132	291358	273674	277079	250860	231151	217646	224860	220803	263865	255599	180048	4662
Tropical Western Pacific (?)				2424	10912	13802	30662	32872	32360	45675	47634	45152	41558	56217	75286	83791	79867	63744	2163
SHEBA (Surface HEat Budget of the Arctic) (?)					1645	6622													
Niamey, Niger; Mobile Facility (?)													898	15267	263				
Point Reyes CA, USA; Mobile Facility (?)													8314	289					
Black Forest, Germany; Mobile Facility (?)															12410	44			
Shouxian, Anhui, China; Mobile Facility (?)																11986	6		
Graciosa Island, Azores, Portugal; Mobile Facility (?)																	19408	21349	272
Steamboat Springs CO, USA; Mobile Facility																		969	248

Recovery Act: Introduction

- $60M from DOE Office of Science for investments in instrumentation and research infrastructure to support the instrumentation and the associated increase in data volume and complexity
- 3-dimensional measurements of cloud scale dynamics, microphysics, and precipitation
- Enhanced measurements of atmospheric aerosol composition and chemistry
- Enhance measurement base to bridge new knowledge into, and improve, the predictive performance of climate models

http://www.arm.gov/about/recovery-act

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Recovery Act: Update

- Precipitation and cloud radars installed at the SGP
- 35 GHz radars upgraded at SGP, Darwin, and Manus
- HSRL lidars installed at Barrow and Steamboat Springs
- Raman lidar installed at Darwin
- Aircraft instruments flown as part of CARES and CalWater
- Infastructure upgrades well under way at all sites
- Many other instruments (e.g. ceilometers, AERIs)

- Remaining installations include precipitation radar at Manus, scanning cloud radars beyond the SGP, microwave radiometers,

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Upcoming Field Campaigns: MC3E

Midlatitude Continental Convective Clouds Experment (MC3E):
April 22 – June 6, 2011 at the SGP ARM site

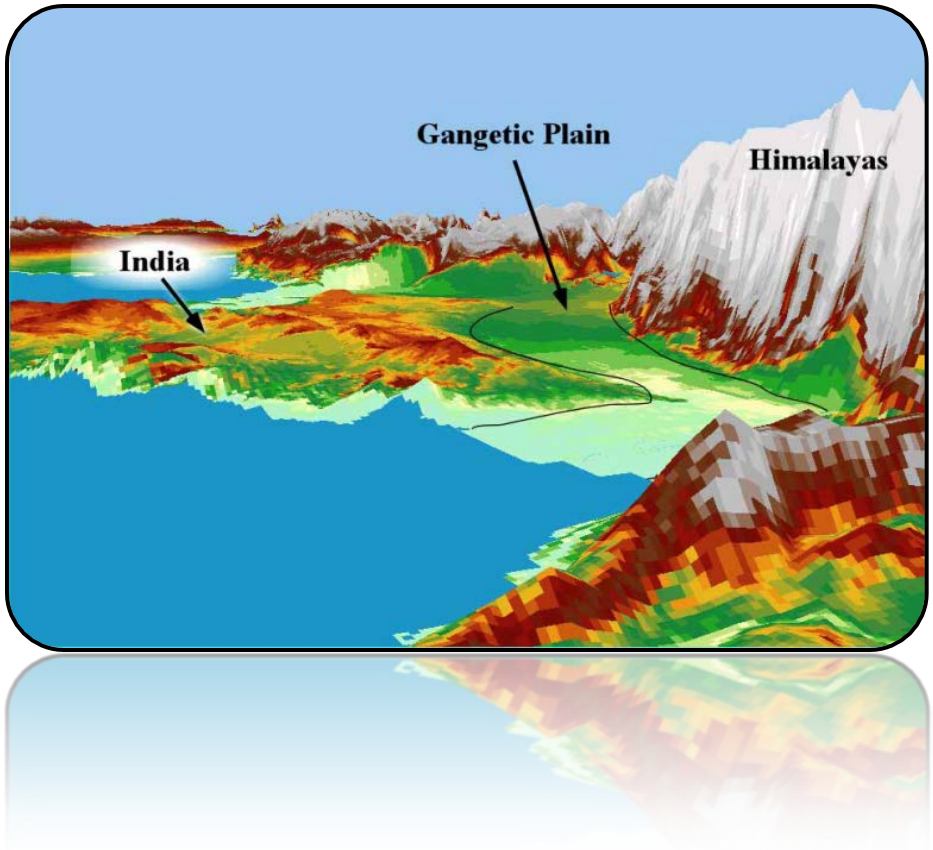
- Joint campaign with NASA
- ARM components include: scanning radars, wind profilers in precipitation mode in multi-doppler lobes, radiosonde array
- NASA components include ER2 and North Dakota Citation and the NPOL Doppler radar
- Additional ground based measurements from NASA and NOAA

http://campaign.arm.gov/mc3e

Upcoming Field Campaigns: GVAX

Ganges Valley Aerosol Experiment (GVAX)
June 2011 – March 2012

GVAX will use the first ARM Mobile Facility to obtain measurements of clouds, precipitation, and aerosols to study the impact of aerosols cloud formation and monsoon Activity.



http://www.arm.gov/sites/amf/pgh

Upcoming Field Campaigns: AMIE

ARM MJO Investigation Experiment (AMIE)

Two Components: Gan Island (AMF2) in the Indian Ocean and Manus Island (C-band radar and radiosondes)

- AMIE runs from Oct. 1, 2011 through Mar. 31, 2012
- AMIE/DYNAMO a hypothesis testing driven effort
  - Hypotheses significantly formed using models due to lack of in-situ data
- Gives inherent synergy between observational and modeling efforts

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Part II: How do I …

- Find a datastream
- Order a datastream
- Read a NetCDF file
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- Find out what's going on around the program
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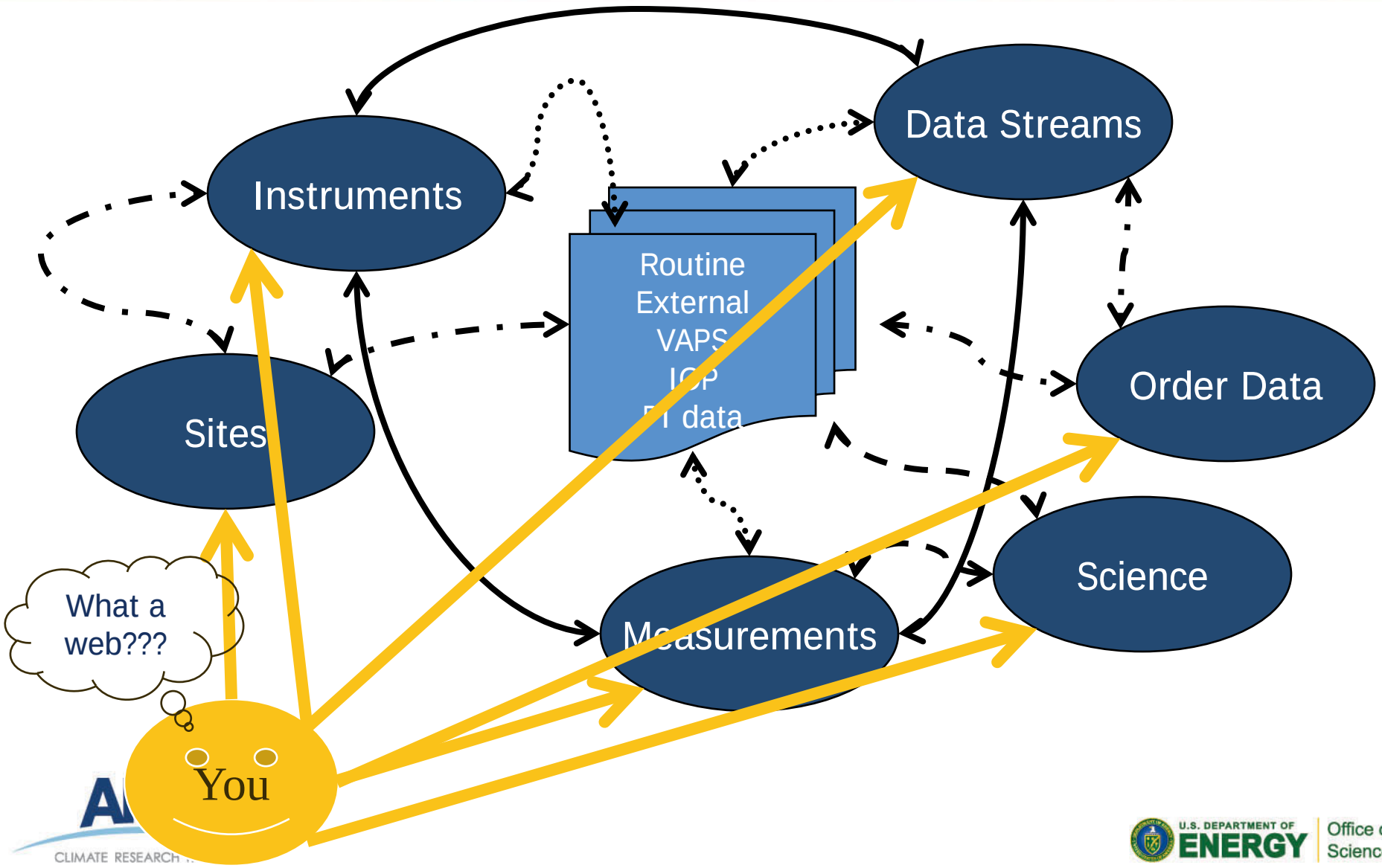
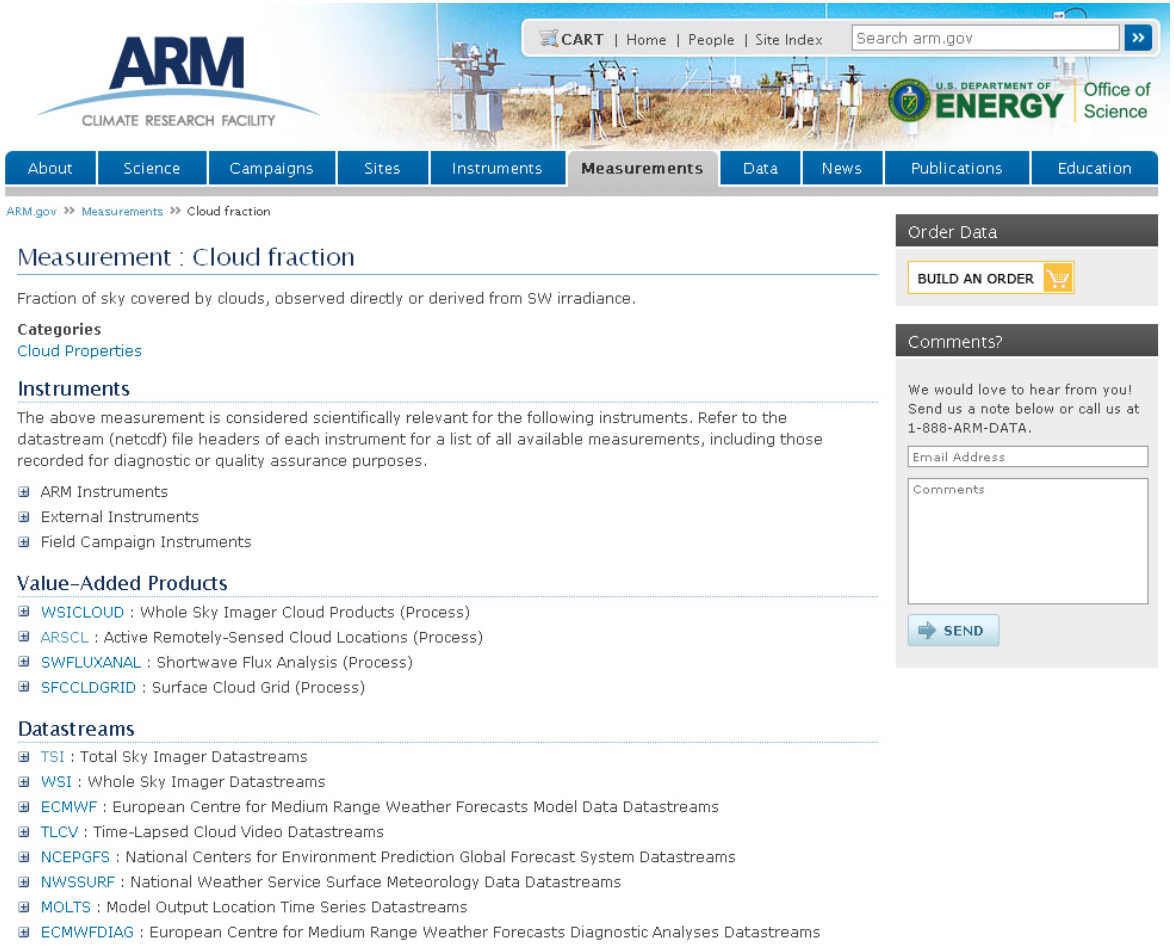
Wandering around ARM Web “stuff”



How Do I Find a Datastream for a Specific Measurement?

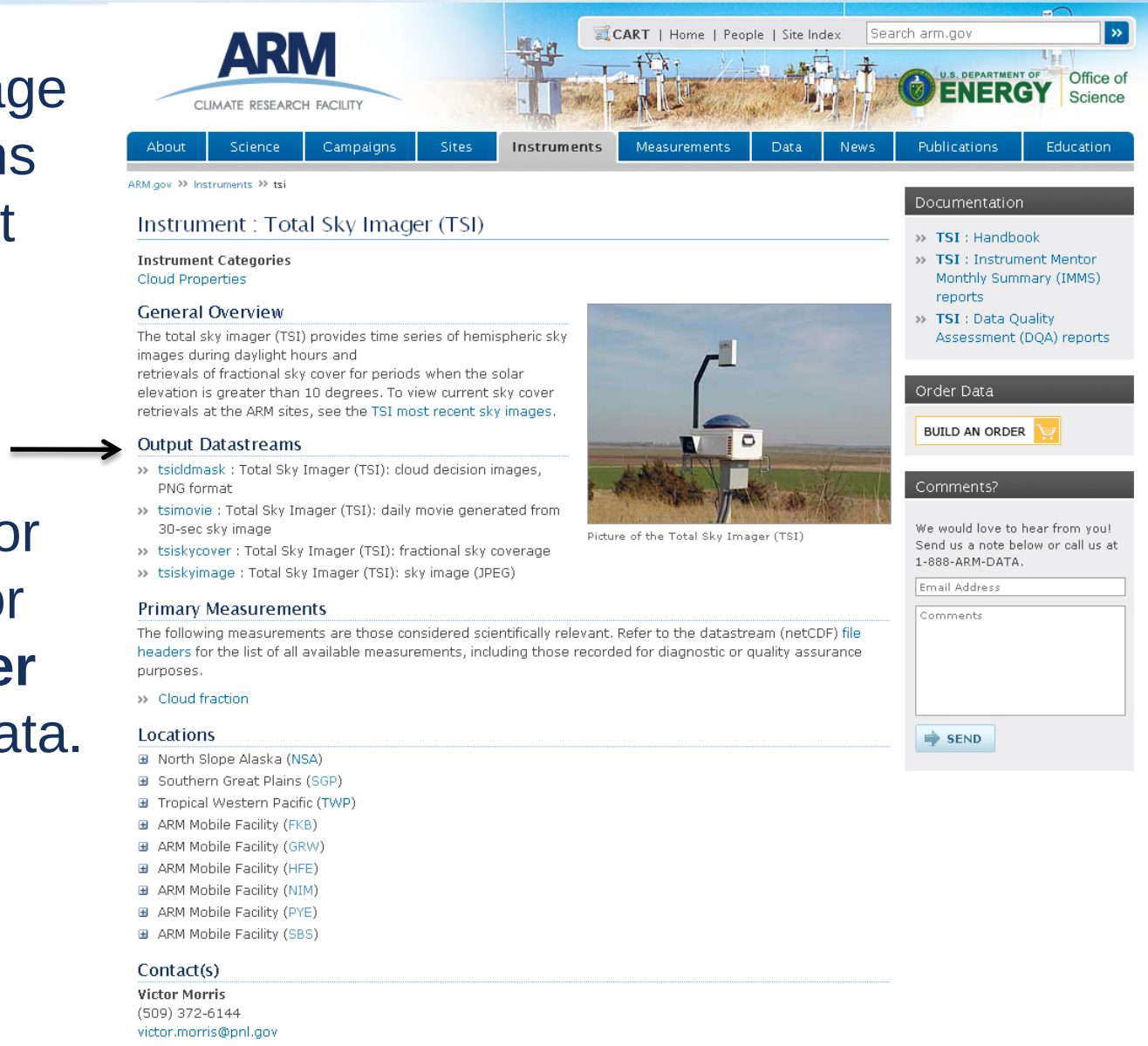
Each measurement page lists the datastreams that include that measurement. Click the datastream name or click **Build an Order.**



How Do I Find a Datastream for a Specific Instrument?

Each instrument page lists the datastreams associated with that instrument.

You can click on a datastream name for more information, or click **Build an Order** to begin ordering data.



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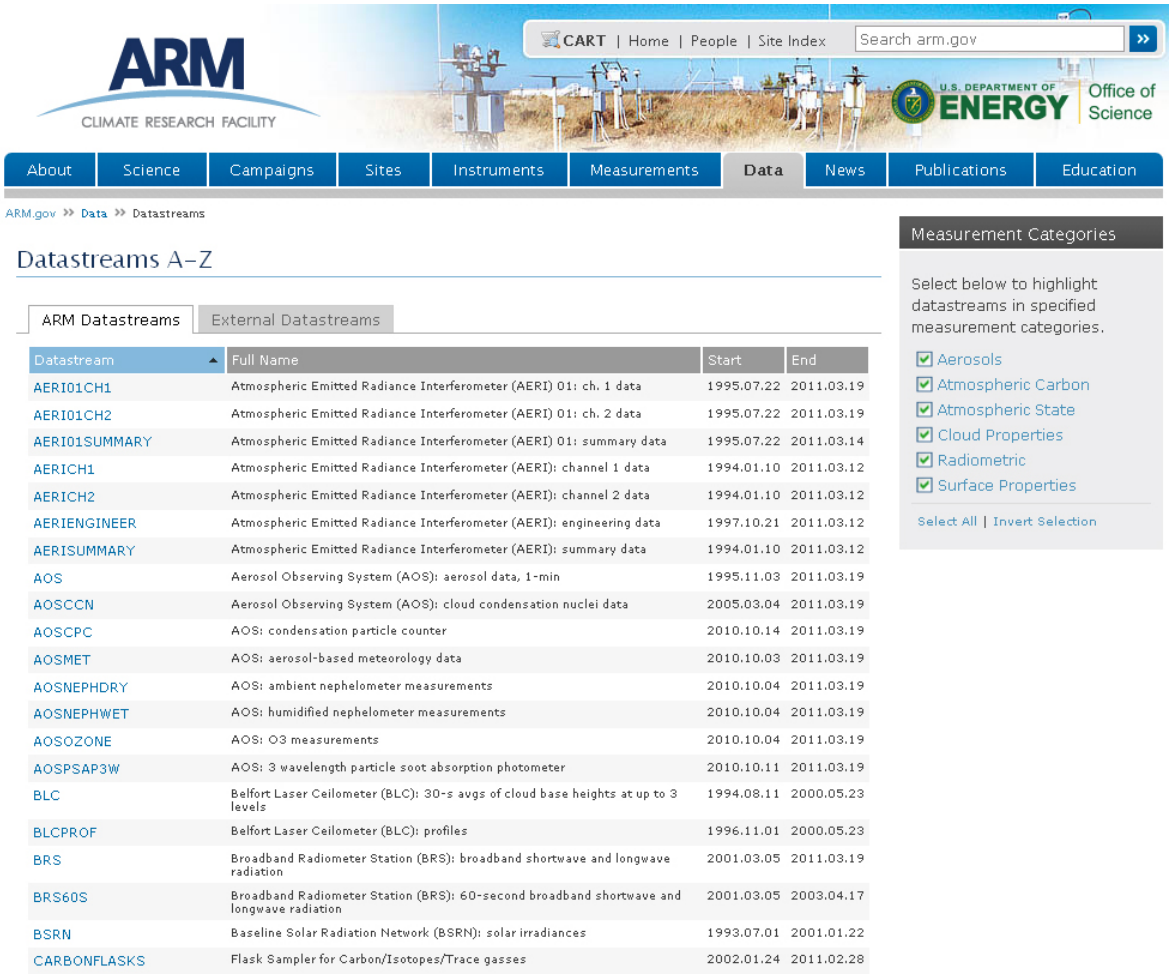
How Do I Find a Datastream by Name?

The Datastreams A-Z page lists all datastreams in alphabetical order by full name.

To access this page, select **Datastreams** under the **Data** tab on the ARM website.

http://www.arm.gov/data/datastreams

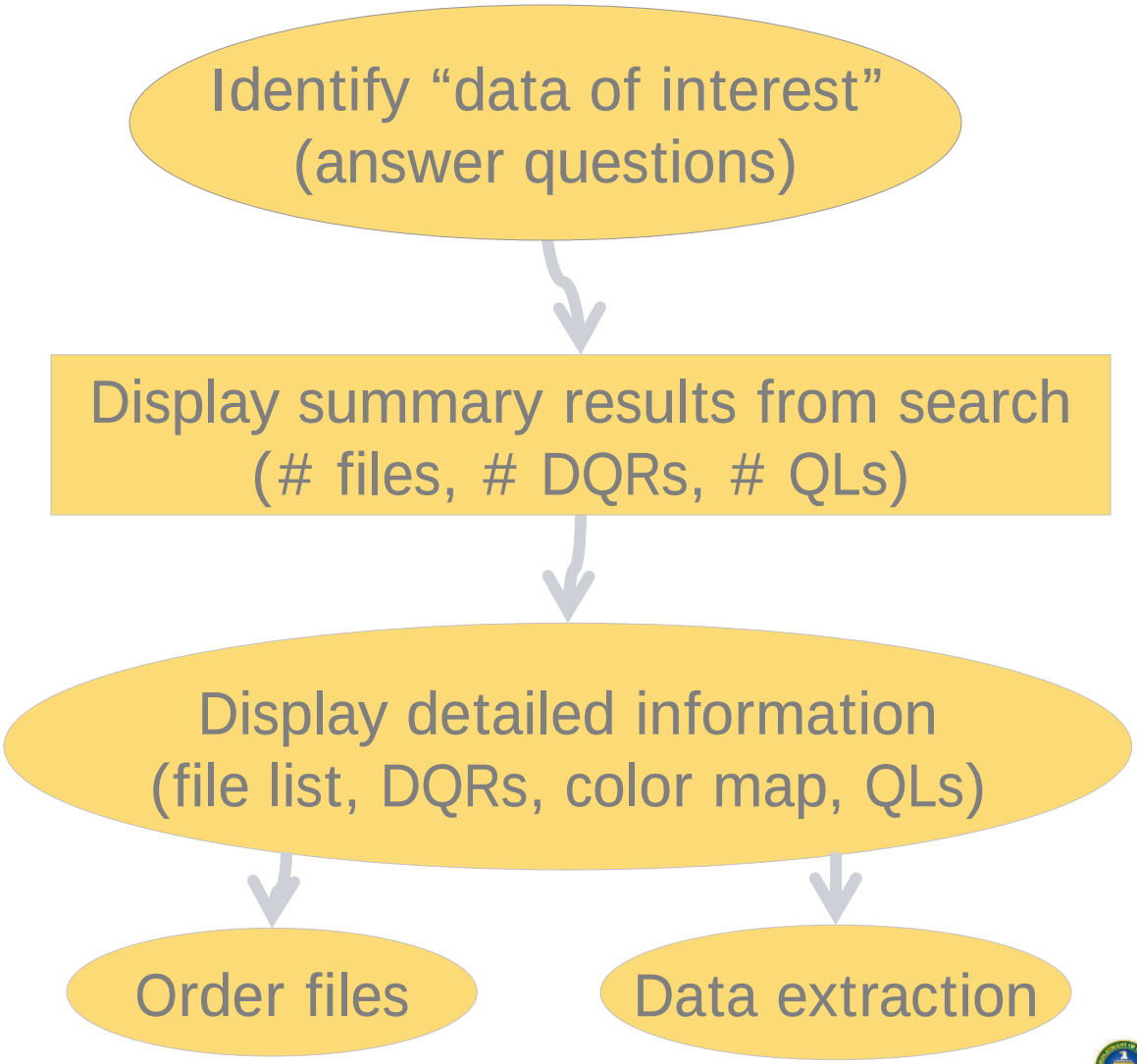


Datastream	Full Name	Start	End
AERI01CH1	Atmospheric Emitted Radiance Interferometer (AERI) 01: ch. 1 data	1995.07.22	2011.03.19
AERI01CH2	Atmospheric Emitted Radiance Interferometer (AERI) 01: ch. 2 data	1995.07.22	2011.03.19
AERI01SUMMARY	Atmospheric Emitted Radiance Interferometer (AERI) 01: summary data	1995.07.22	2011.03.14
AERICH1	Atmospheric Emitted Radiance Interferometer (AERI): channel 1 data	1994.01.10	2011.03.12
AERICH2	Atmospheric Emitted Radiance Interferometer (AERI): channel 2 data	1994.01.10	2011.03.12
AERIENGINEER	Atmospheric Emitted Radiance Interferometer (AERI): engineering data	1997.10.21	2011.03.12
AERISUMMARY	Atmospheric Emitted Radiance Interferometer (AERI): summary data	1994.01.10	2011.03.12
AOS	Aerosol Observing System (AOS): aerosol data, 1-min	1995.11.03	2011.03.19
AOSCCN	Aerosol Observing System (AOS): cloud condensation nuclei data	2005.03.04	2011.03.19
AOSCPC	AOS: condensation particle counter	2010.10.14	2011.03.19
AOSMET	AOS: aerosol-based meteorology data	2010.10.03	2011.03.19
AOSNEPHDRY	AOS: ambient nephelometer measurements	2010.10.04	2011.03.19
AOSNEPHWET	AOS: humidified nephelometer measurements	2010.10.04	2011.03.19
AOSOZONE	AOS: O3 measurements	2010.10.04	2011.03.19
AOSPSAP3W	AOS: 3 wavelength particle soot absorption photometer	2010.10.11	2011.03.19
BLC	Belfort Laser Ceilometer (BLC): 30-s avgs of cloud base heights at up to 3 levels	1994.08.11	2000.05.23
BLCPROF	Belfort Laser Ceilometer (BLC): profiles	1996.11.01	2000.05.23
BRS	Broadband Radiometer Station (BRS): broadband shortwave and longwave radiation	2001.03.05	2011.03.19
BRS60S	Broadband Radiometer Station (BRS): 60-second broadband shortwave and longwave radiation	2001.03.05	2003.04.17
BSRN	Baseline Solar Radiation Network (BSRN): solar irradiances	1993.07.01	2001.01.22
CARBONFLASKS	Flask Sampler for Carbon/Isotopes/Trace gasses	2002.01.24	2011.02.28

Comparison of Interface Options

Data Cart	Routine ARM data and some IOP data	*"I need to read about what you have, then I will decide."* Discover areas of interest by browsing the ARM web documentation and collect items of interest.
Data Browser	Routine ARM data	*"I know what I want. Do you have it?"* Searching with predefined selection criteria.
Catalog Interface	Routine ARM data	*"I am not sure what I want. I need to see what you have available."* Browsing a hierarchy of availability summaries.
Thumbnail Browser	Most routine ARM data	*"I will know what I want when I see it."* Searching with a combination of predefined selection criteria and visual review of data plots
NCVWeb	Routine ARM Data	*"I want to see my own data plot."* Interactive data plotting tool with visualizing, extracting, statistics generation capabilities.
Statistical Browser	Special Data (CMBE, QCRAD, CONSTRVARANA)	*"I need to see climatological summary of cloud and radiation data at ARM sites, then I'll drill down further."* Gain insight via statistical plots at the main sites for various time periods. Download statistics, measurements and files.
"IOP" Data Browser	IOP, PI, Showcase and beta data	*"I need to look in the odd parts bin."* Direct access to IOP data. Navigate /year/site/iop directory tree. Also use narrow Google search.

Typical Logic behind Data Access Tools

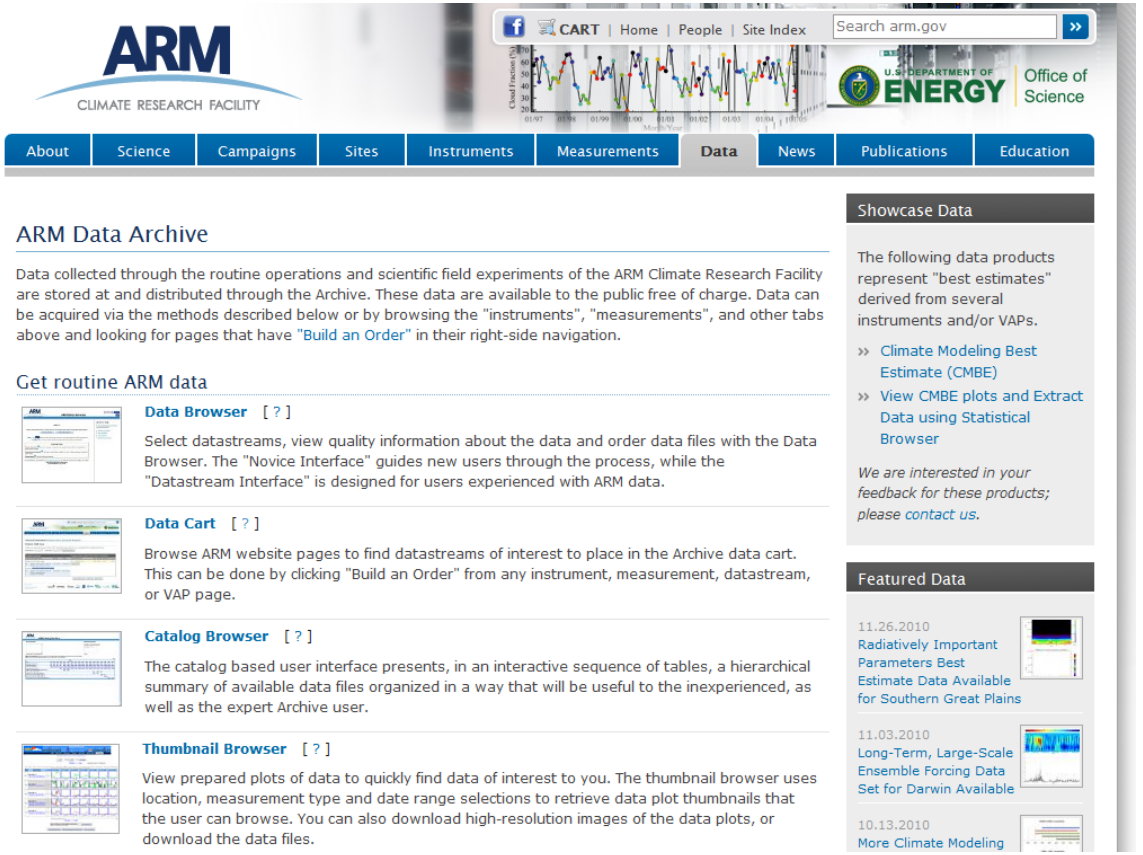


Who are you?
Who wants to know?

- Archive users must register.
- Notification helps you with data access.
- ARM infrastructure is a “National User Facility”
  - provides access to extra budget!!
  - OMB requests User Facilities to report user statistics for several “demographic categories”
- Some personal information is required*
    - *personal information is not reported individually and is accessible only to Archive staff after entry

How do I order data?

In addition to the “Build an Order” options on the Instrument and Measurement pages, there are several browsers available to find and order data. →



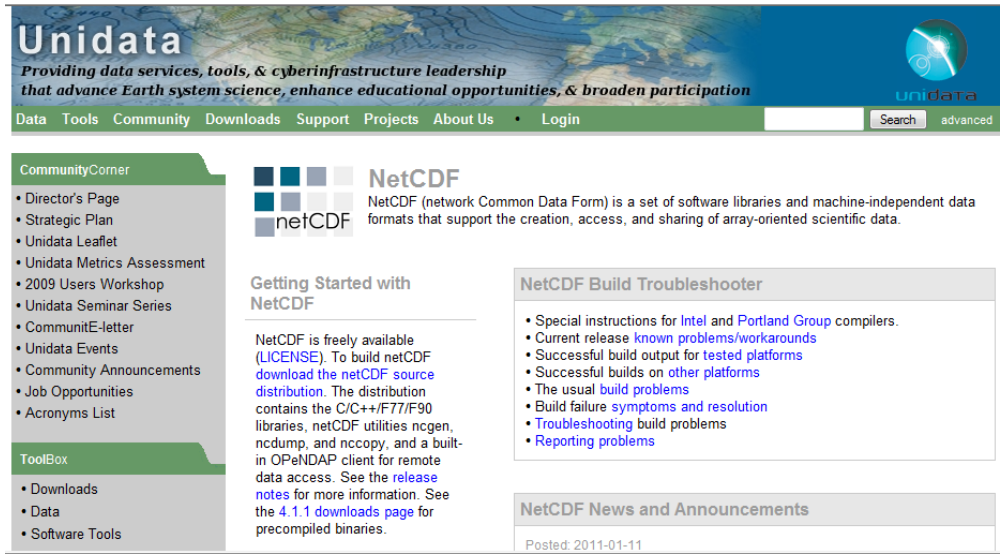
http://www.archive.arm.gov/

How Do I Read NetCDF Data?

NetCDF is a self-describing scientific data format. There are many tools available to read NetCDF. Some of these are referenced under the ARM website data tab: http://www.arm.gov/data/tools. Further details are available at the Unidata NetCDF website.

Supported languages include:
C, C++, Fortran,
Matlab, IDL,
Python, Java, R, …

If you have questions – Ask! There is a lot of experience around the program.



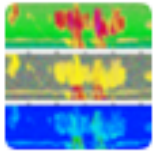
Data Quality Assessment

The assessment of data quality is managed by the ARM Data Quality Office
http://dq.arm.gov/

Types of Quality Information

- Automated products
  - QC flags
    - inserted in data files during processing
  - Summaries of flags (data color)
- Manual products
  - Data Quality Reports (DQRs)
    - web accessible reports; delivered as html files after data requests; event driven and problem-based
  - Instrument Mentor Monthly Summary Reports
    - web accessible; linked to instrument web pages.
  - Data Quality Assessment Reports

DQ HandS



- QC Metrics and Plots
- Plot Browser
- DQ wiki

NCVweb

- Interactive Data Plotting

DQ Reports

- Search All Reports
- DQ Assessment Reports
- Report Findings

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How Do I Submit a Research Highlight?

Research Highlights are an efficient way to exchange results with your colleagues. They're used in annual reports and other high-level documents, as well as in program reviews and outreach materials.

http://asr.science.energy.gov

To access the Research Highlights Submittal Form:

1. On the ASR website, click **Science**.
2. Click **Research Highlights**.
3. Click **Submit a Highlight**.

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How Do I Submit a Research Highlight?

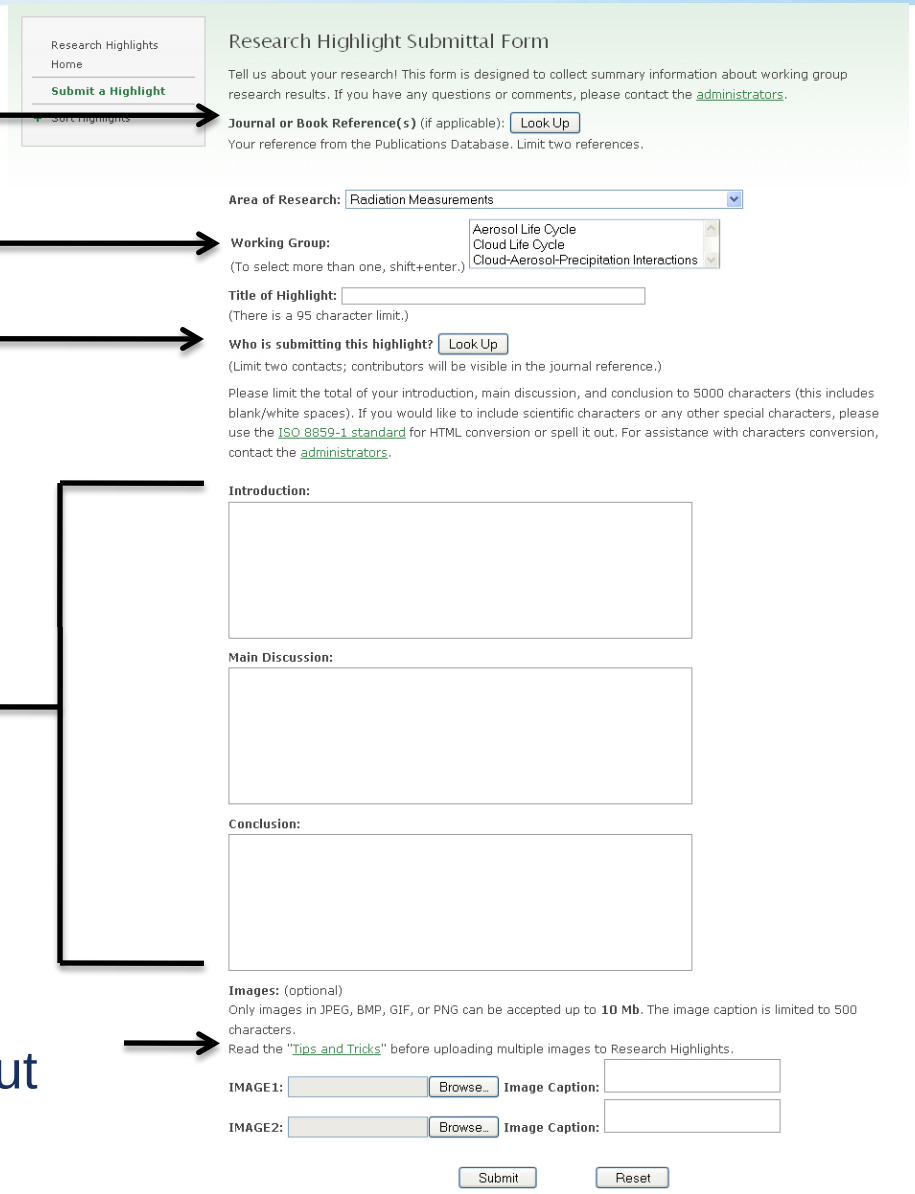
Select or submit up to two associated publications.

Select your area of research and ASR working group.

Enter the title and use the Look Up button to select up to two contacts.

Enter the Introduction, Main Discussion, and Conclusion.

You can enter up to two images with captions, but they are not required.



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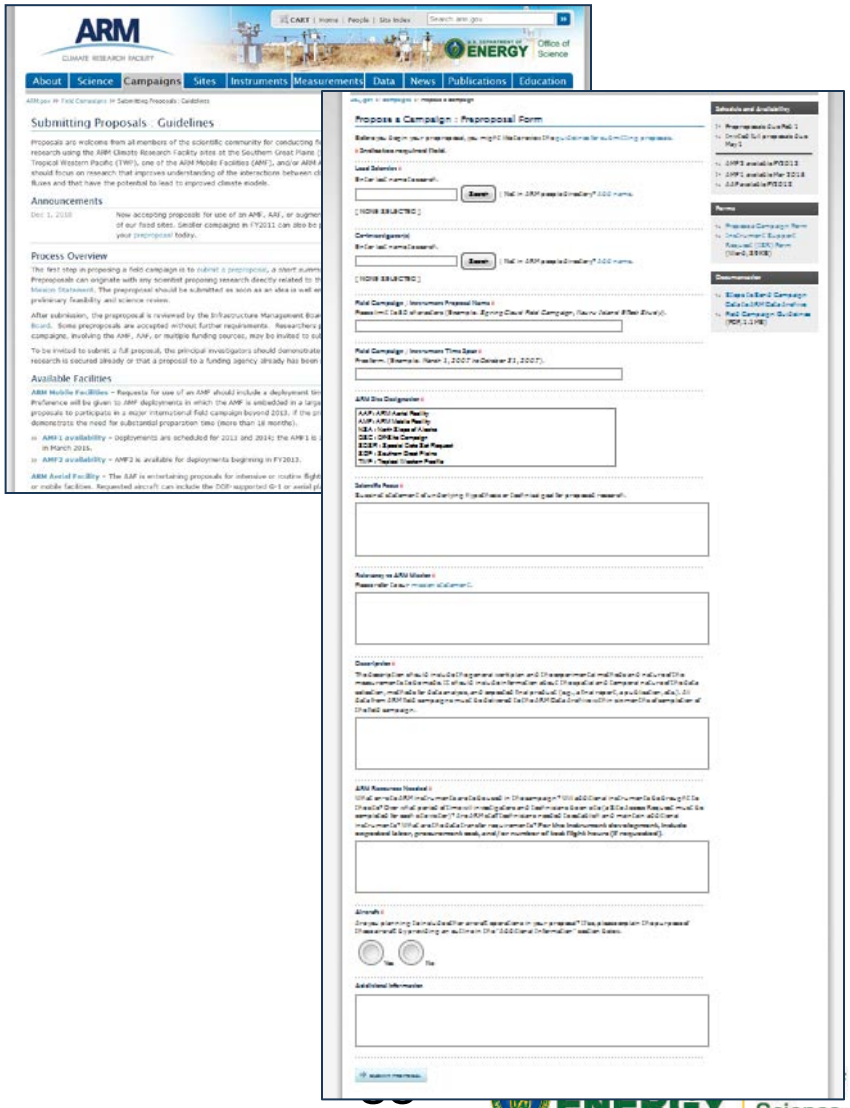
How Do I Submit a Field Campaign Request?

- First, review the guidelines for submitting proposals.
- Next, submit a preproposal; a short summary of the proposed campaign.
- Wait for a response from the Infrastructure Management Board (IMB) and/or ARM Science Board.
- A full proposal or science plan may be requested.



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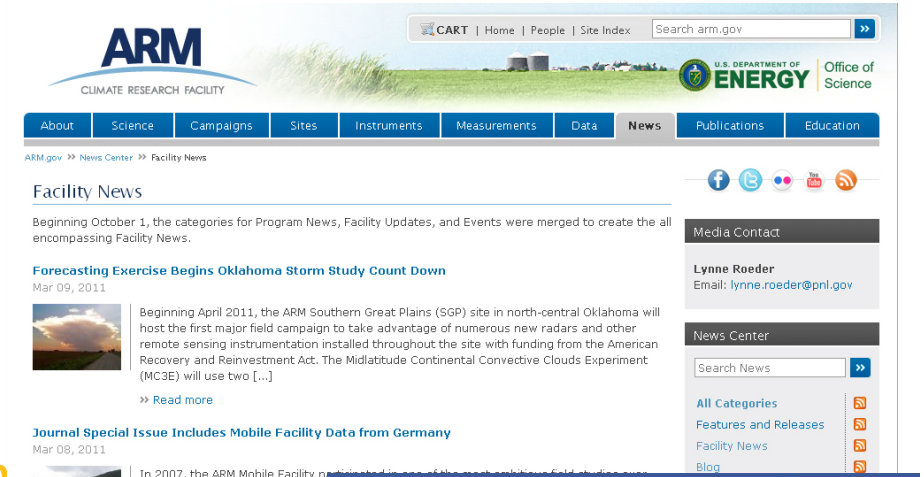
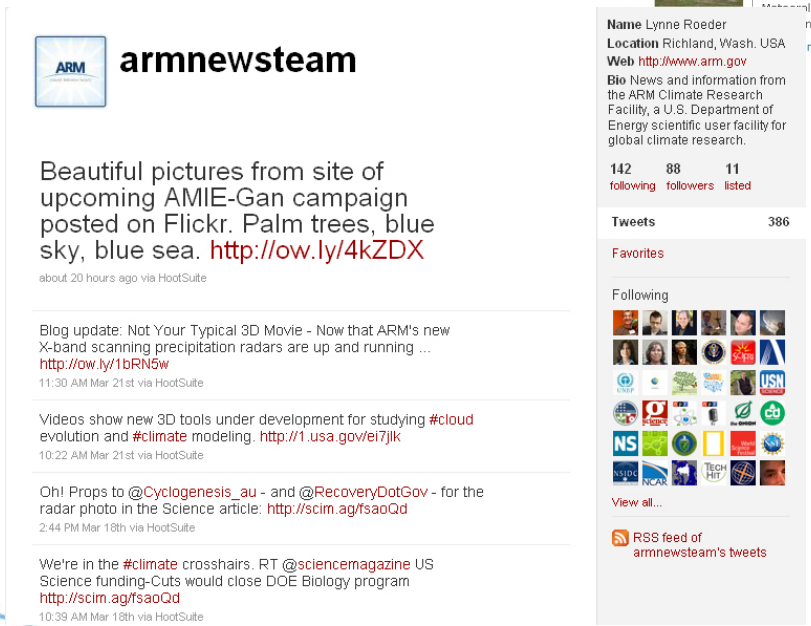
ENERGY | Science

How Do I Stay Connected?

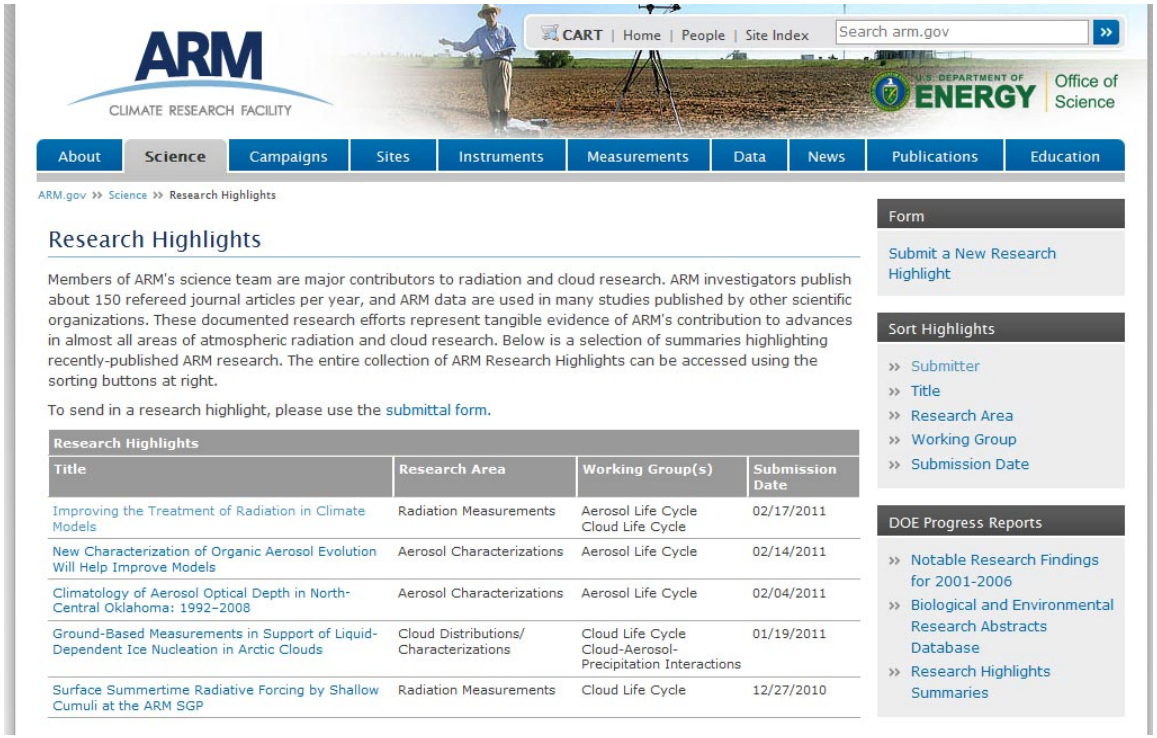
- ARM News Center
  http://www.arm.gov/news/
- Facebook
  http://www.facebook.com/arm.gov
- Twitter
  http://twitter.com/armnewsteam





How Do I Stay Connected?

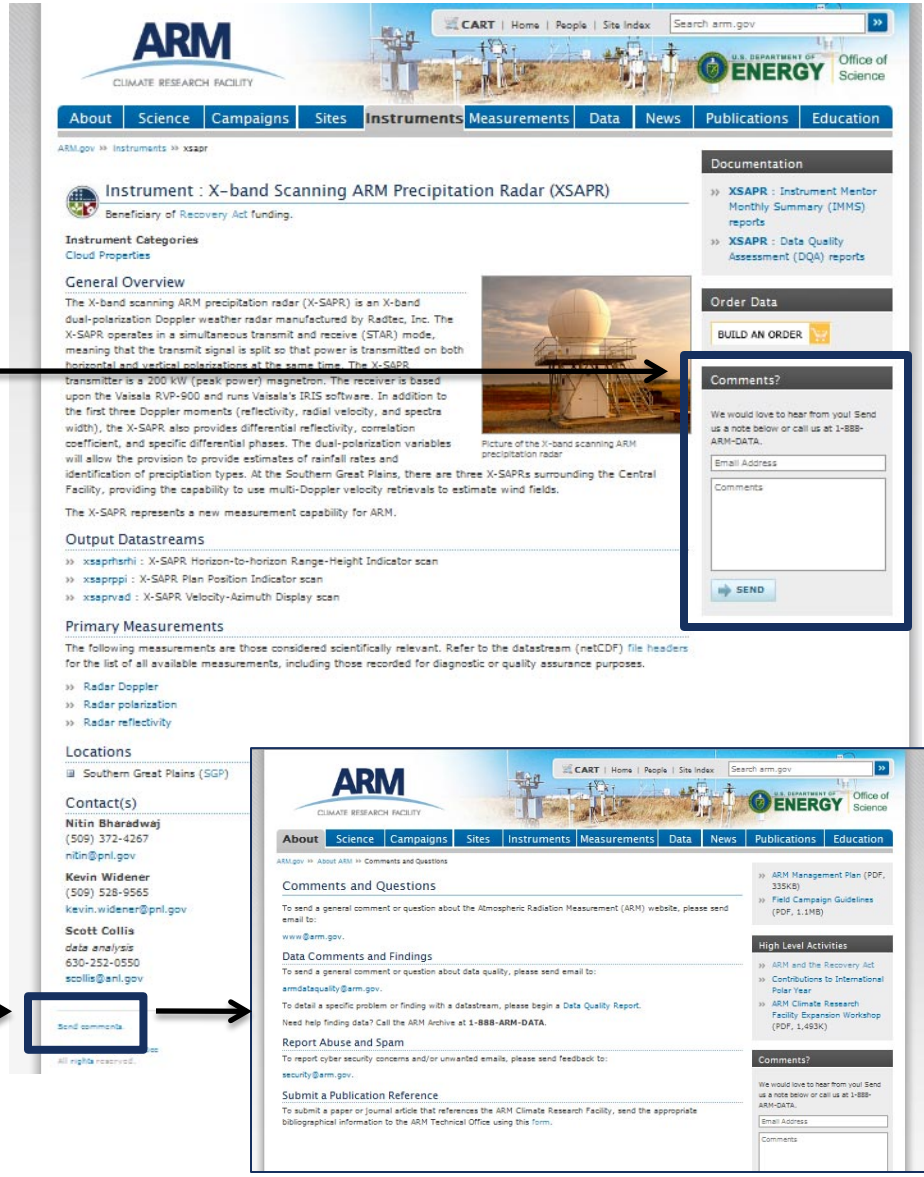
- Research Highlights
  http://www.arm.gov/news/research or
  http://www.arm.gov/science/highlights



How Do I Submit a Question?

http://www.arm.gov/

- Data/instrument issue
  - Use comment box on their web pages
- General questions
  - Go to Contacts page, linked off of every web page
- Needed measurement suggestions
  - Contact any SISC member or send it in through the web on the Contacts page



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- Description of sites, instruments, data
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For More Information on ASR

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- Description of working groups
- Science highlights
- Meeting information
- Links to ARM resources
- Contacts

Visit the ASR website:
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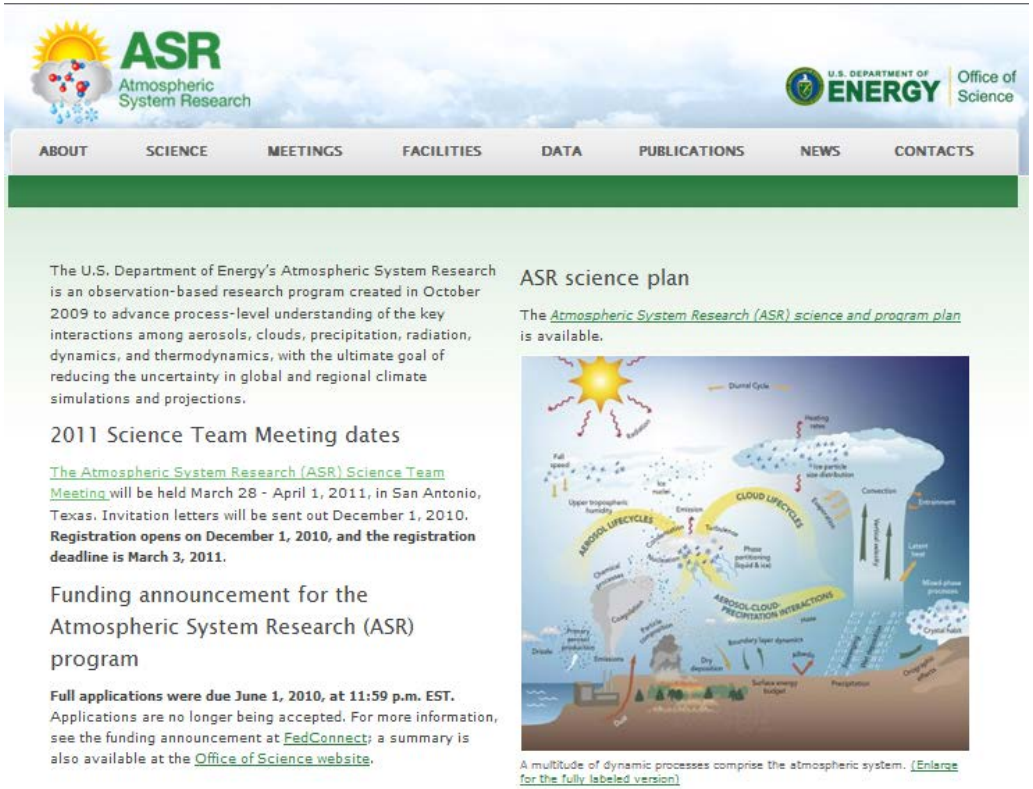

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