

Instrumentation Overview

ARM Climate Research Facility

18th Annual ARM Science Team Meeting

Jimmy Voyles



Presentation Outline



Presentation Outline

- Program Science Goals and Approach



Presentation Outline

- Program Science Goals and Approach
- Research Sites



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Presentation Outline

- Program Science Goals and Approach
- Research Sites
- Instrument Strategy



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Presentation Outline

- Program Science Goals and Approach
- Research Sites
- Instrument Strategy
- Instrumentation



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Presentation Outline

- Program Science Goals and Approach
- Research Sites
- Instrument Strategy
- Instrumentation
- Instrument Team



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Presentation Outline

- Program Science Goals and Approach
- Research Sites
- Instrument Strategy
- Instrumentation
- Instrument Team
- Instrument Documentation



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Presentation Outline

- Program Science Goals and Approach
- Research Sites
- Instrument Strategy
- Instrumentation
- Instrument Team
- Instrument Documentation
- Conclusion



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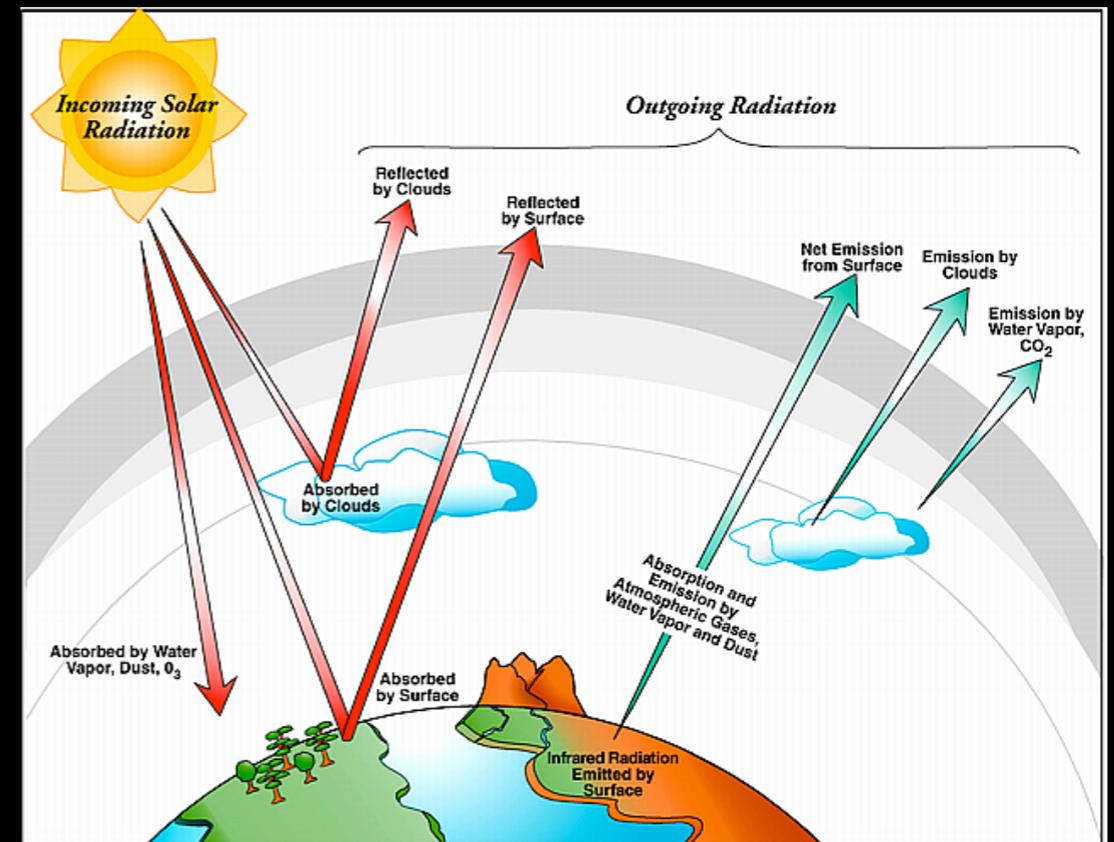
Presentation Outline

- Program Science Goals and Approach
- Research Sites
- Instrument Strategy
- Instrumentation
- Instrument Team
- Instrument Documentation
- Conclusion



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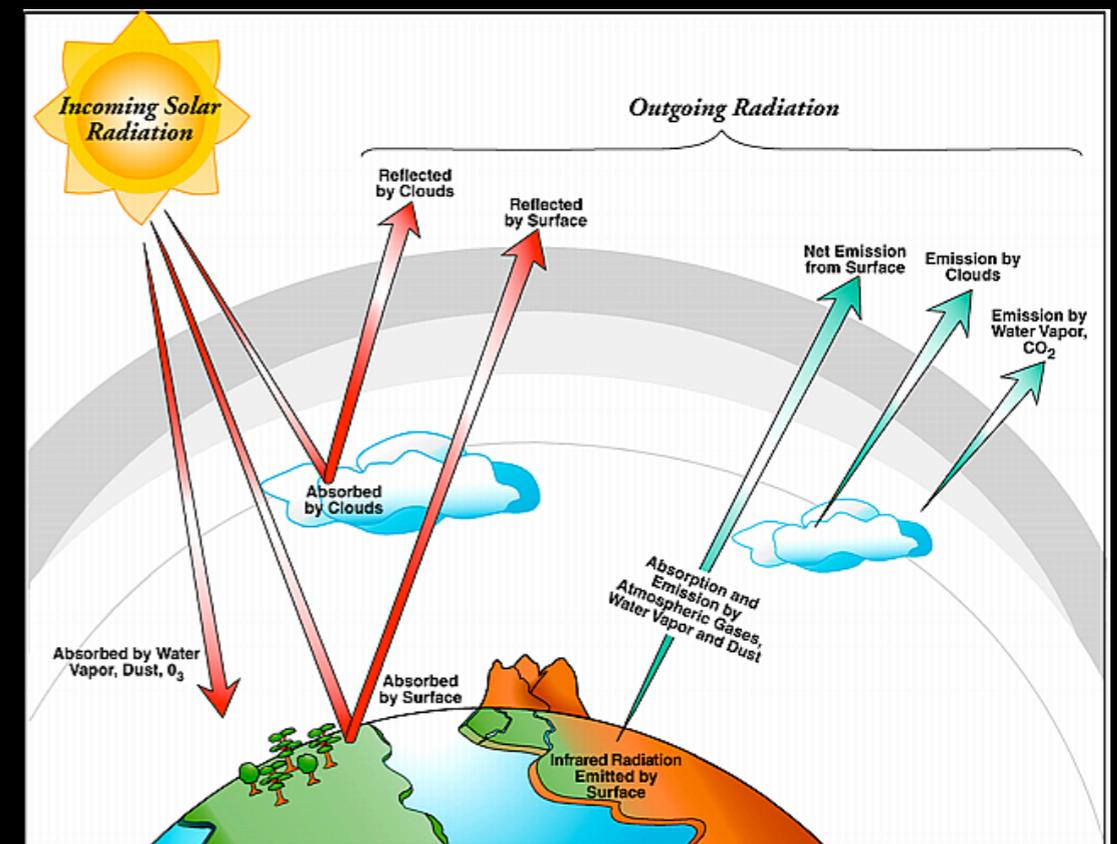
Science Goals



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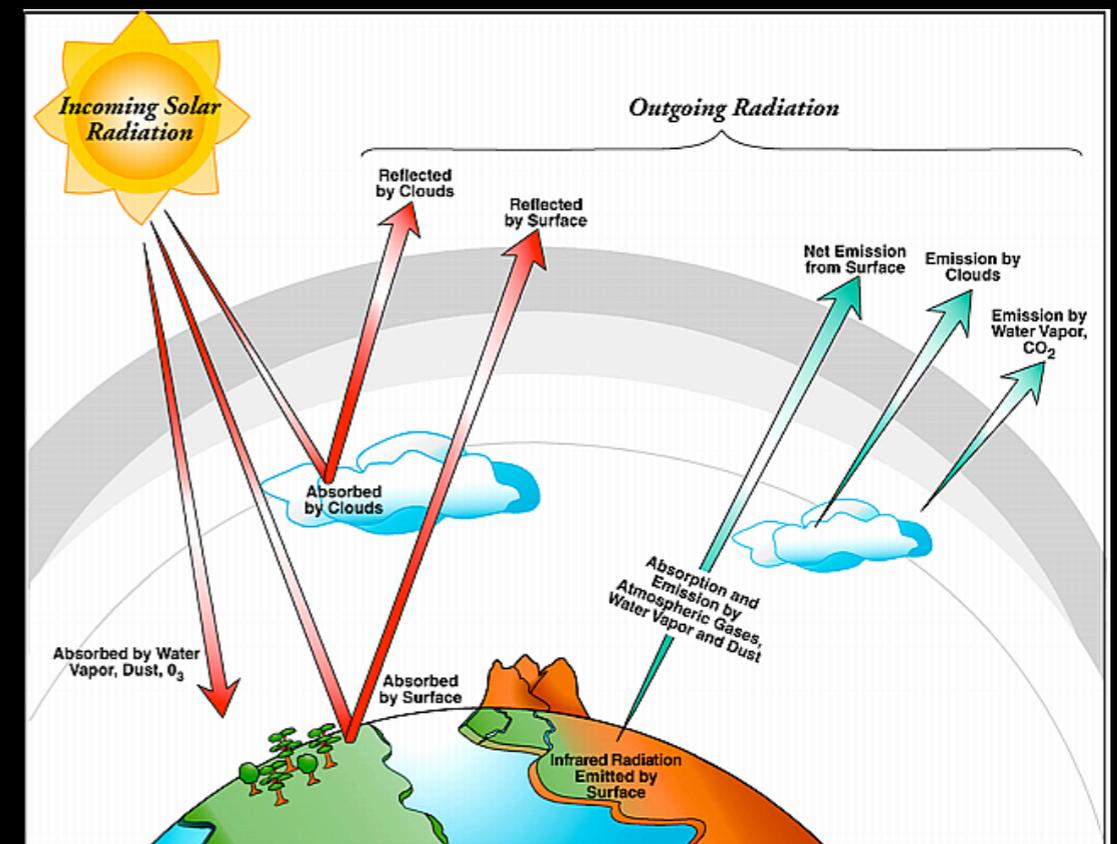
Science Goals

- Improve the understanding of processes and properties that affect atmospheric radiation, particularly the influence of clouds and cloud radiative feedback.



Science Goals

- Improve the understanding of processes and properties that affect atmospheric radiation, particularly the influence of clouds and cloud radiative feedback.
- To improve climate models by developing and testing improved physical representations of cloud and radiative processes.



Approach



Approach

- Relate observed radiative energy fluxes to temperature, water vapor, clouds, and surface properties.



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Approach

- Relate observed radiative energy fluxes to temperature, water vapor, clouds, and surface properties.
- Acquire observations over a wide range of climatic conditions.



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Approach

- Relate observed radiative energy fluxes to temperature, water vapor, clouds, and surface properties.
- Acquire observations over a wide range of climatic conditions.
- Acquire observations over climatically meaningful (decadal) time scales.



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Approach

- Relate observed radiative energy fluxes to temperature, water vapor, clouds, and surface properties.
- Acquire observations over a wide range of climatic conditions.
- Acquire observations over climatically meaningful (decadal) time scales.
- Provide freely available high quality data.



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Research Sites



Research Sites

- Southern Great Plains



Research Sites

- Southern Great Plains
- Tropical Western Pacific



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Research Sites

- Southern Great Plains
- Tropical Western Pacific
- North Slope of Alaska



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Research Sites

- Southern Great Plains
- Tropical Western Pacific
- North Slope of Alaska
- ARM Mobile Facility



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Research Sites

- Southern Great Plains
- Tropical Western Pacific
- North Slope of Alaska
- ARM Mobile Facility
- Aerial Vehicles Program



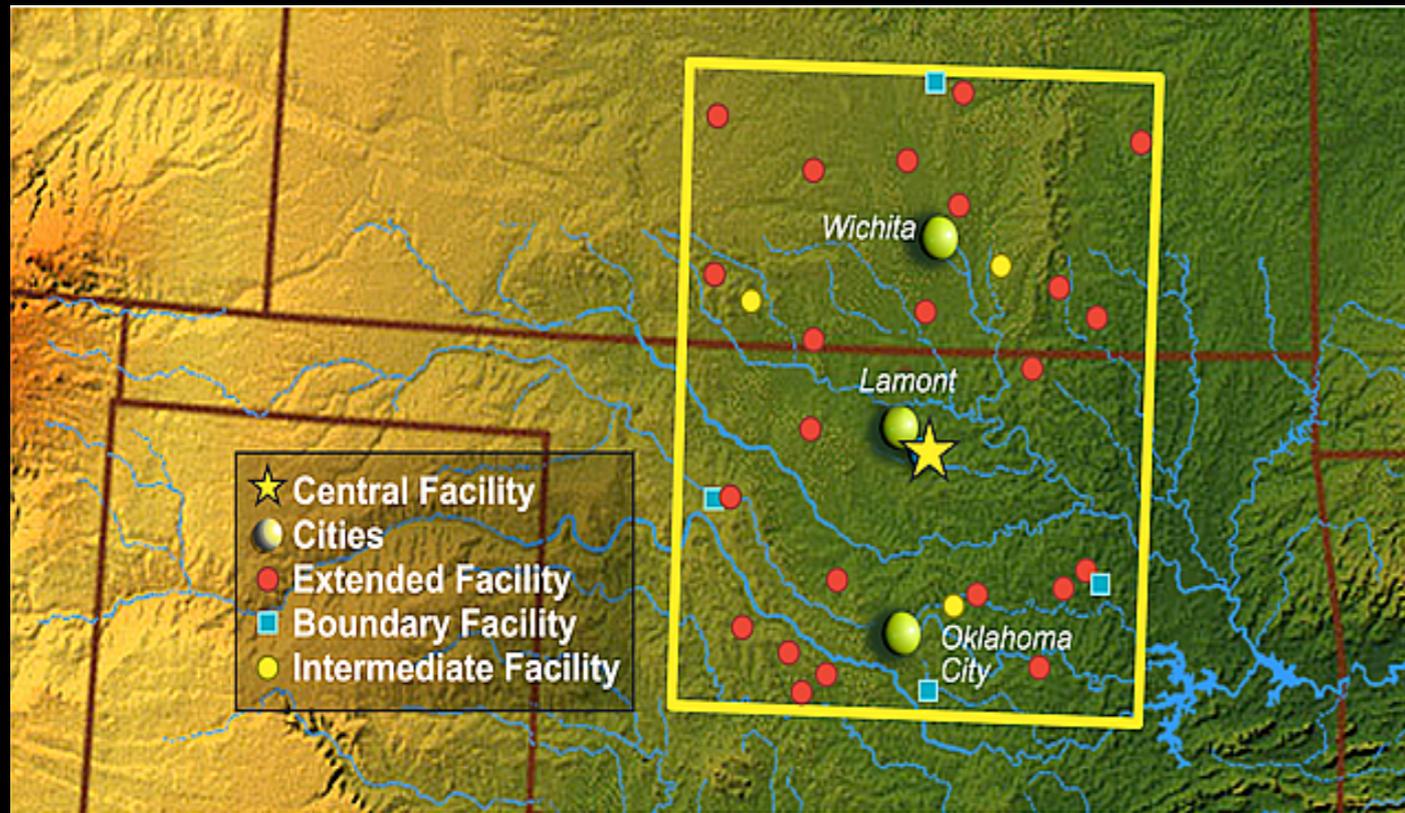
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Research Sites

- Southern Great Plains
- Tropical Western Pacific
- North Slope of Alaska
- ARM Mobile Facility
- Aerial Vehicles Program
- Field Campaigns



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Established 1992

Southern Great Plains



Established

Tropical Western Pacific



Manus 1996

Established

Tropical Western Pacific



Manus 1996



Nauru 1998



Established

Tropical Western Pacific



Manus 1996



Nauru 1998



Darwin 2003

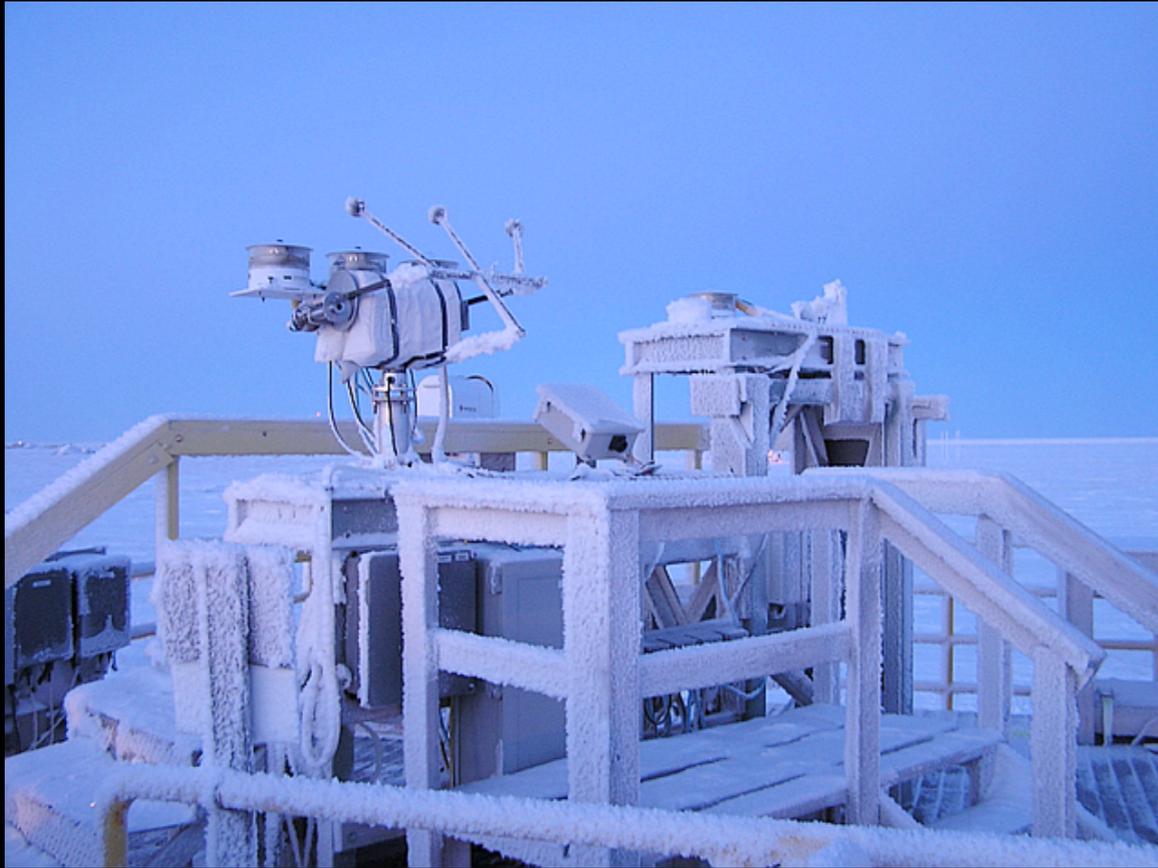
Established

Tropical Western Pacific



Established

North Slope of Alaska



Barrow 1997



Established

North Slope of Alaska



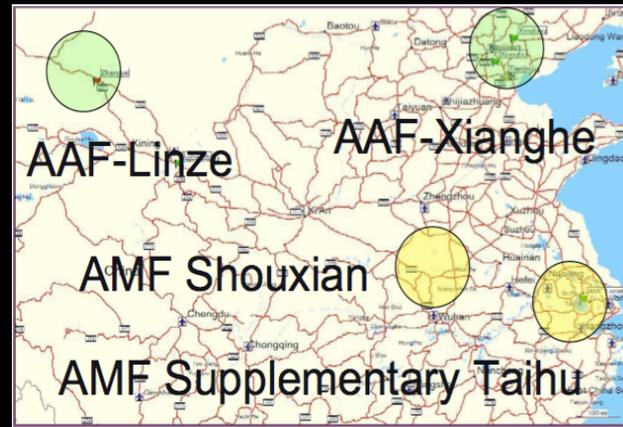
Barrow 1997



Atqasuk 1999

Established

North Slope of Alaska

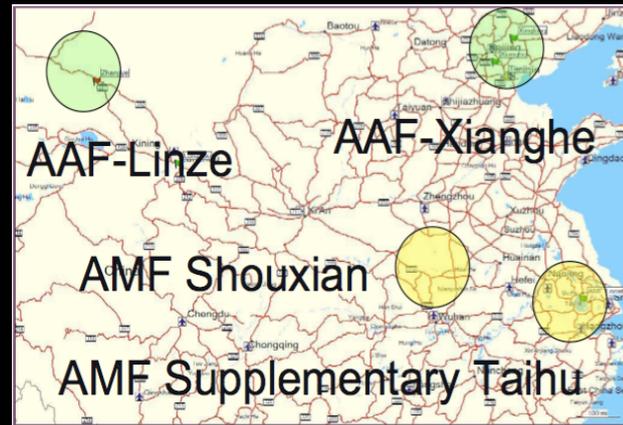


Established 2005

ARM Mobile Facility



Pt. Reyes, CA - 2005



Established 2005

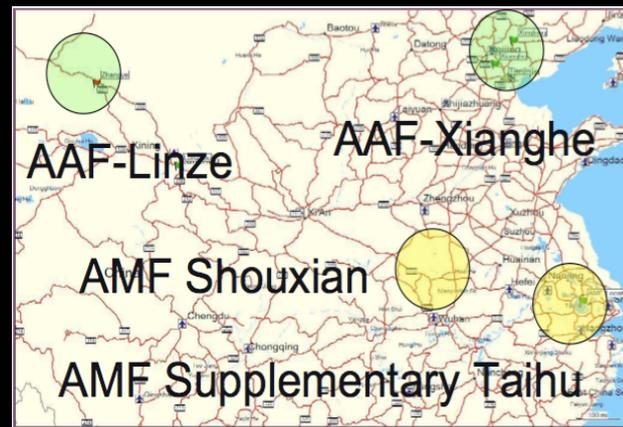
ARM Mobile Facility



Pt. Reyes, CA - 2005



Niamey, Niger - 2006



Established 2005

ARM Mobile Facility



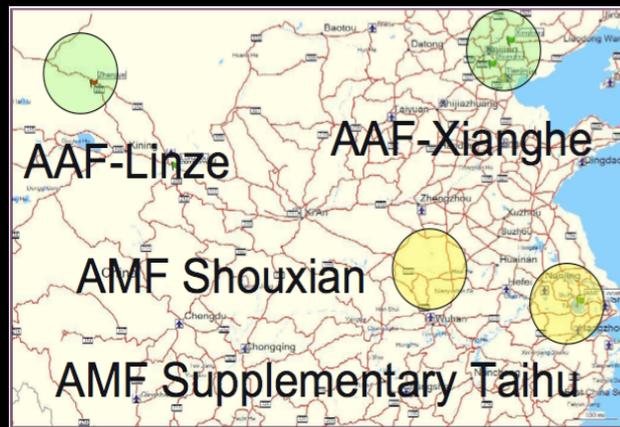
Pt. Reyes, CA - 2005



Niamey, Niger - 2006



Black Forest, Germany - 2007



Established 2005

ARM Mobile Facility



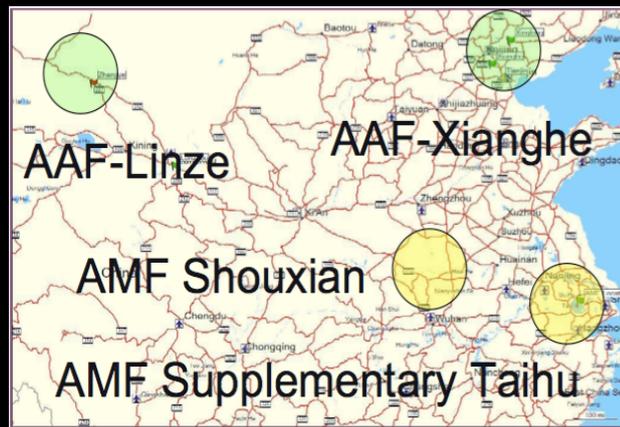
Pt. Reyes, CA - 2005



Niamey, Niger - 2006



Black Forest, Germany - 2007



Shouxian, China - 2008



Established 2005

ARM Mobile Facility



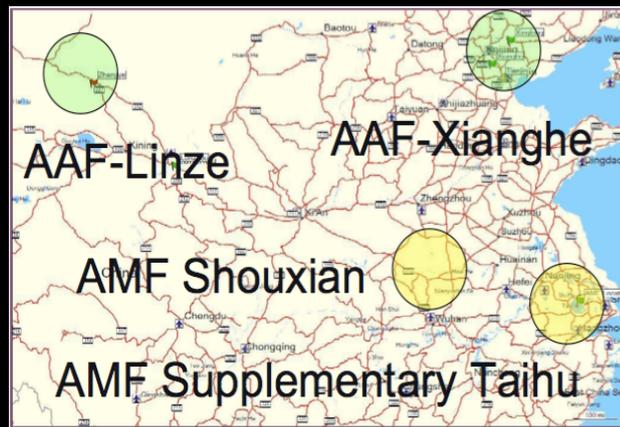
Pt. Reyes, CA - 2005



Niamey, Niger - 2006



Black Forest, Germany - 2007



Shouxian, China - 2008



Azores - 2009

Established 2005

ARM Mobile Facility



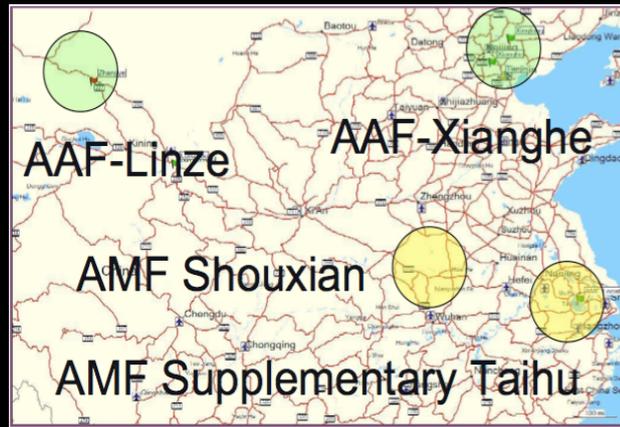
Pt. Reyes, CA - 2005



Niamey, Niger - 2006



Black Forest, Germany - 2007



Shouxian, China - 2008



Azores - 2009

2010 - ?

Established 2005

ARM Mobile Facility



Annual

Established 2007

Aerial Vehicles Program



ARM 

VIEW CART | PEOPLE | SITE INDEX | HOME

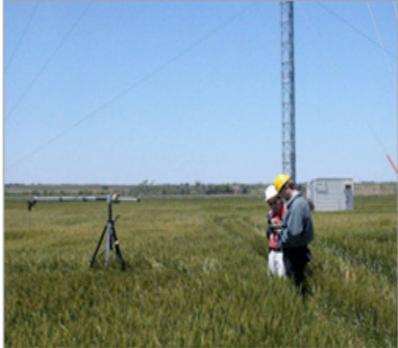
SEARCH

ABOUT ARM | **ABOUT ACRF** | SCIENCE | SITES | INSTRUMENTS | MEASUREMENTS | DATA | PUBLICATIONS | EDUCATION | FORMS

User Information | Field Campaigns | Capabilities & Products | Organization | Operations Updates | Facility Statistics | Contacts

Field Campaigns

Proposals for smaller campaigns this fiscal year, and forward, are still being considered. We are no longer accepting preproposals for use of the AMF and AVP services in FY 2010; invited full proposals are due May 15. Preproposals for routine use of small aircraft in FY 2008-2010 at the Southern Great Plains (SGP) field site are no longer being accepted; invited full proposals are due April 1.



ARM Climate Research Facility users regularly conduct field campaigns to augment routine data acquisitions and to test and validate new instruments. Any field campaign which is proposed, planned, and implemented at one or more research sites is referred to as an intensive operational period (IOP). IOPs are held using the fixed and mobile sites; Southern Great Plains, North Slope of Alaska, Tropical Western Pacific, ARM Mobile Facility (AMF), and Aerial Vehicles Program (AVP). The AVP provides aerial measurement platforms that can be used to support experiments at the fixed sites, in conjunction with the mobile facility, or in support of other research activities independent of the ACRF. While the ACRF does not provide direct funding for scientific research, small amounts of funding may be provided to allow the facility to assist with logistics, the development of datastreams and archiving, and other infrastructure activities associated with using the facility.

[Field Campaigns Home](#)

Apply for a Field Campaign

- [Preproposal Submission Form](#)
- [Instrument Support Request \(ISR\) Form](#)

Search Campaigns

- [Search Form](#)

Browse Campaigns

- [Current Campaigns](#)
- [Upcoming Campaigns](#)
- [Past Campaigns](#)
- [View All Campaigns](#)

Other Field Campaign Information

- [Processes and Guidelines](#)

<http://www.arm.gov/acrf/fc.stm>

Field Campaigns



● Annual Process

The screenshot shows the ARM website's 'Field Campaigns' page. The header includes the ARM logo, navigation links (ABOUT ARM, ABOUT ACRF, SCIENCE, SITES, INSTRUMENTS, MEASUREMENTS, DATA, PUBLICATIONS, EDUCATION, FORMS), and utility links (VIEW CART, PEOPLE, SITE INDEX, HOME, SEARCH). A secondary navigation bar lists categories like User Information, Field Campaigns, Capabilities & Products, etc. The main content area is titled 'Field Campaigns' and contains a text box with a notice about proposal deadlines, a photograph of a field site with a tall tower, and a detailed paragraph about the facility's operations. A right-hand sidebar provides links for 'Apply for a Field Campaign', 'Search Campaigns', 'Browse Campaigns', and 'Other Field Campaign Information'.

Field Campaigns

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Field Campaigns



- Annual Process
- Science Liaison is Moderator

The screenshot shows the ARM website's 'Field Campaigns' page. The top navigation bar includes 'ABOUT ARM', 'ABOUT ACRF', 'SCIENCE', 'SITES', 'INSTRUMENTS', 'MEASUREMENTS', 'DATA', 'PUBLICATIONS', 'EDUCATION', and 'FORMS'. Below this is a secondary navigation bar with 'User Information', 'Field Campaigns', 'Capabilities & Products', 'Organization', 'Operations Updates', 'Facility Statistics', and 'Contacts'. The main content area is titled 'Field Campaigns' and contains a text box with a notice about proposal deadlines, a photograph of a field site with a tall tower, and a detailed paragraph about field campaigns. On the right side, there are links for 'Field Campaigns Home', 'Apply for a Field Campaign' (with sub-links for 'Preproposal Submission Form' and 'Instrument Support Request (ISR) F'), 'Search Campaigns' (with a 'Search Form' link), 'Browse Campaigns' (with links for 'Current Campaigns', 'Upcoming Campaigns', 'Past Campaigns', and 'View All Campaigns'), and 'Other Field Campaign Information' (with a 'Processes and Guidelines' link).

Field Campaigns

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Field Campaigns



- Annual Process
- Science Liaison is Moderator
- Science Board Provides Review

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<http://www.arm.gov/acrf/fc.stm>

Field Campaigns



- Annual Process
- Science Liaison is Moderator
- Science Board Provides Review
- DOE Program Management is the Leader

Field Campaigns

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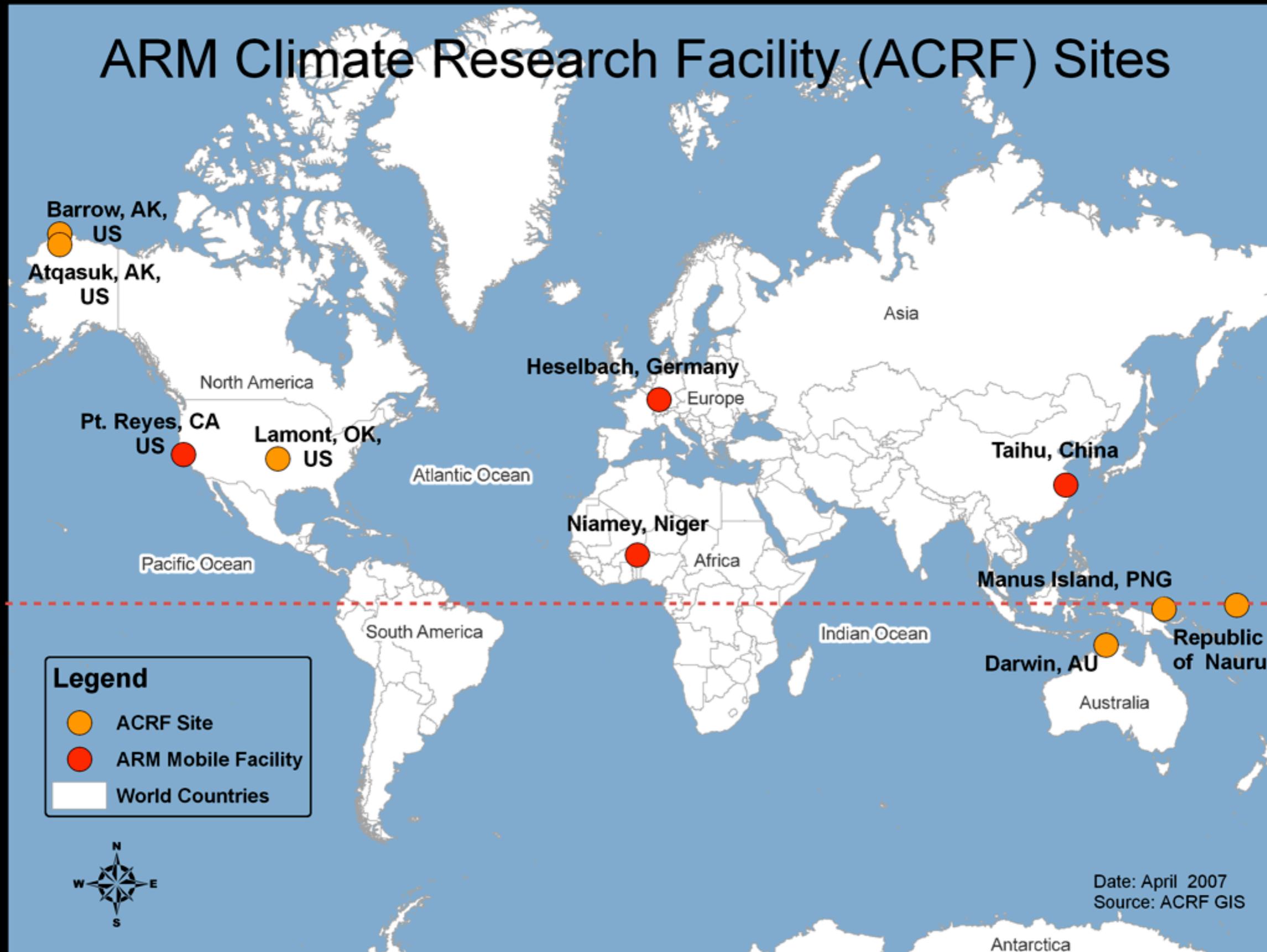
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Field Campaigns

ARM Climate Research Facility (ACRF) Sites



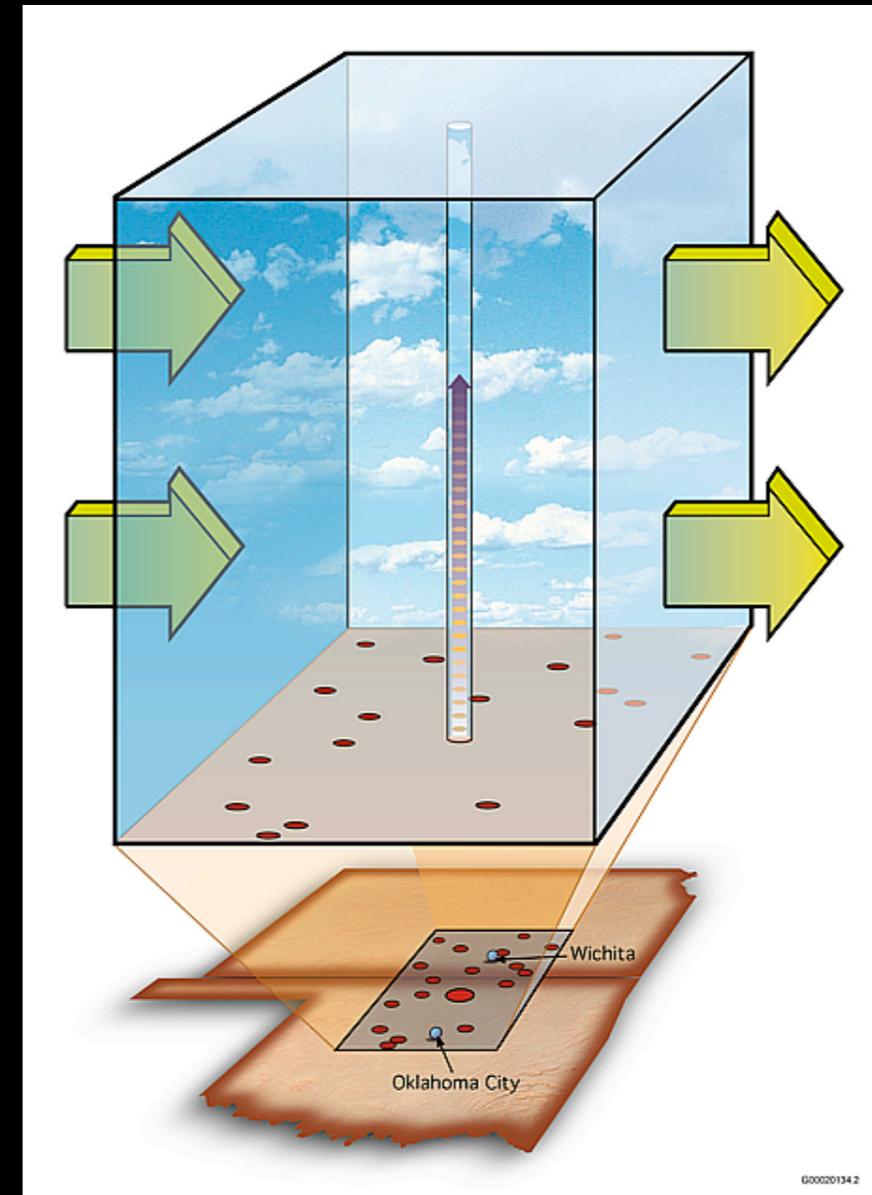
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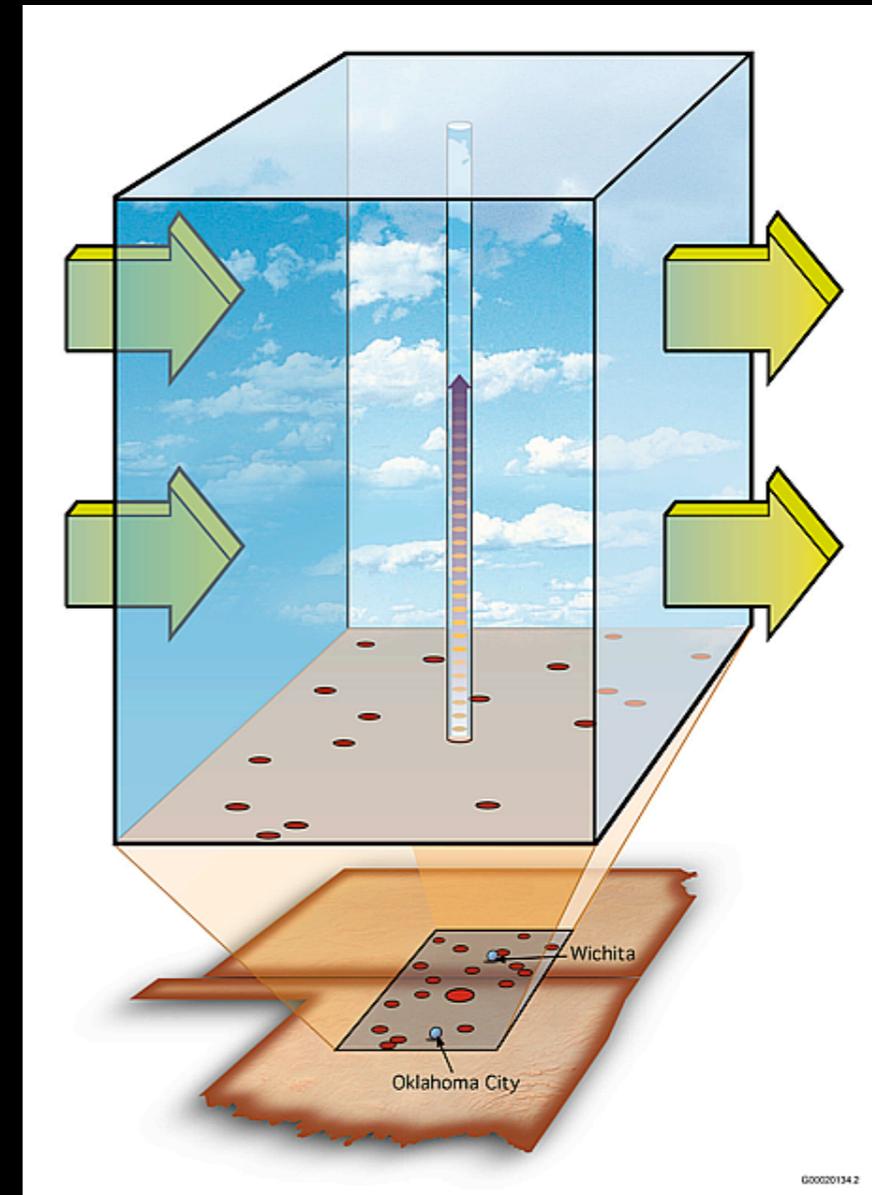
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Measurement Approach



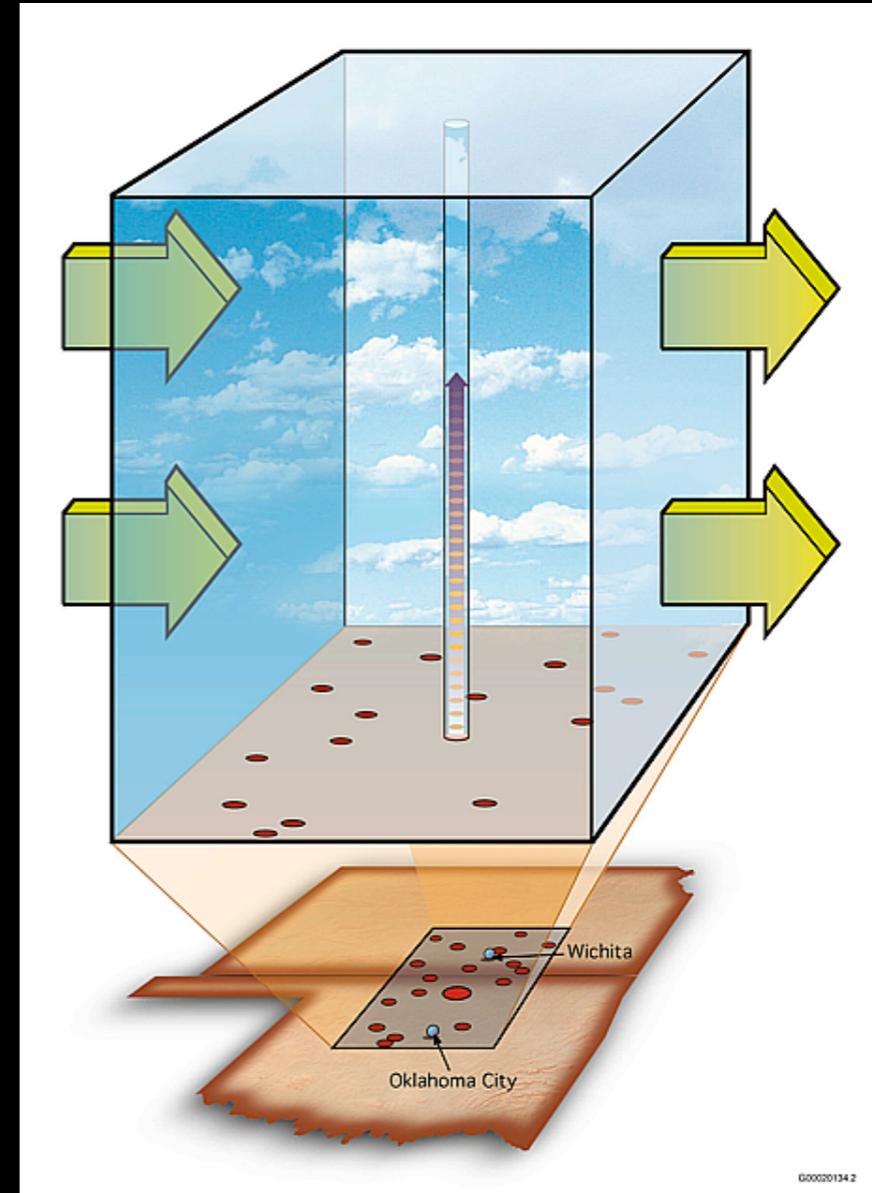
Measurement Approach

- Patterned after a single column model



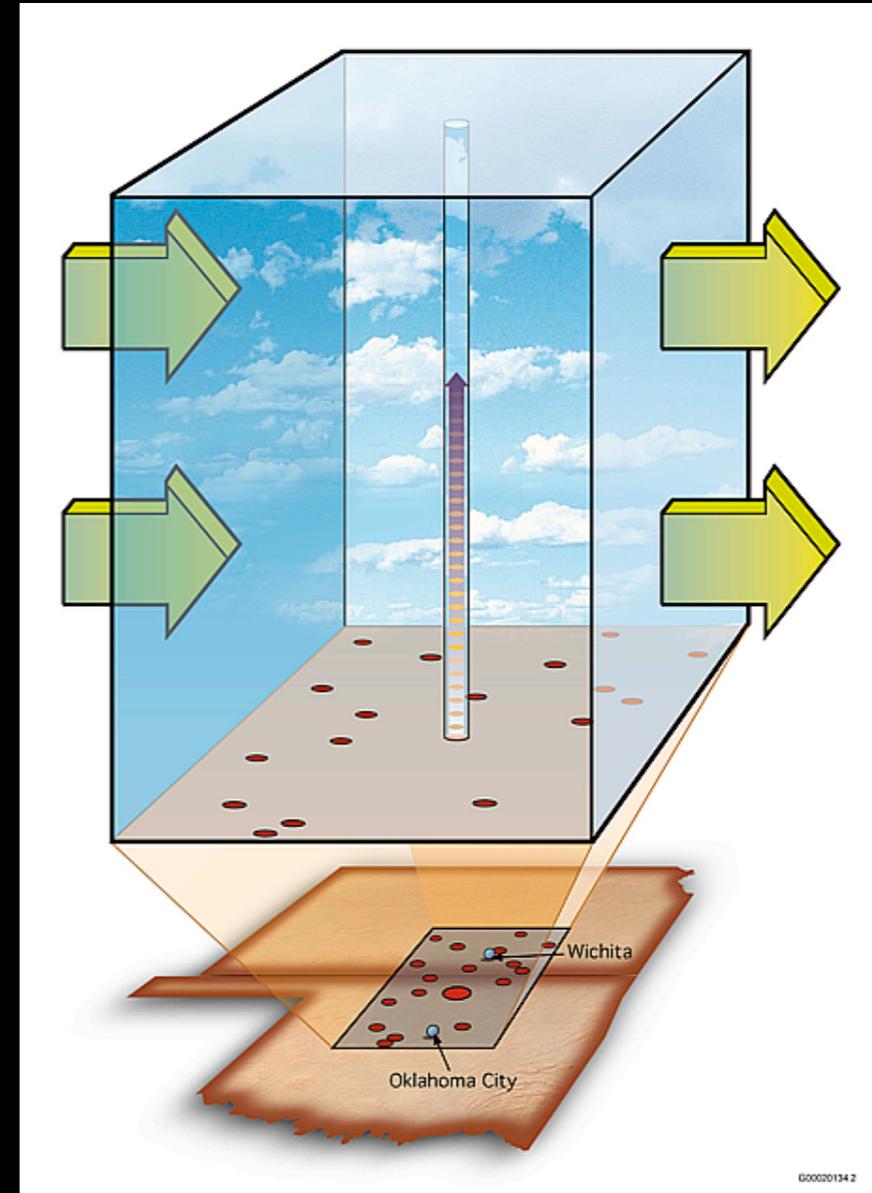
Measurement Approach

- Patterned after a single column model
- Detailed characterization of vertical column



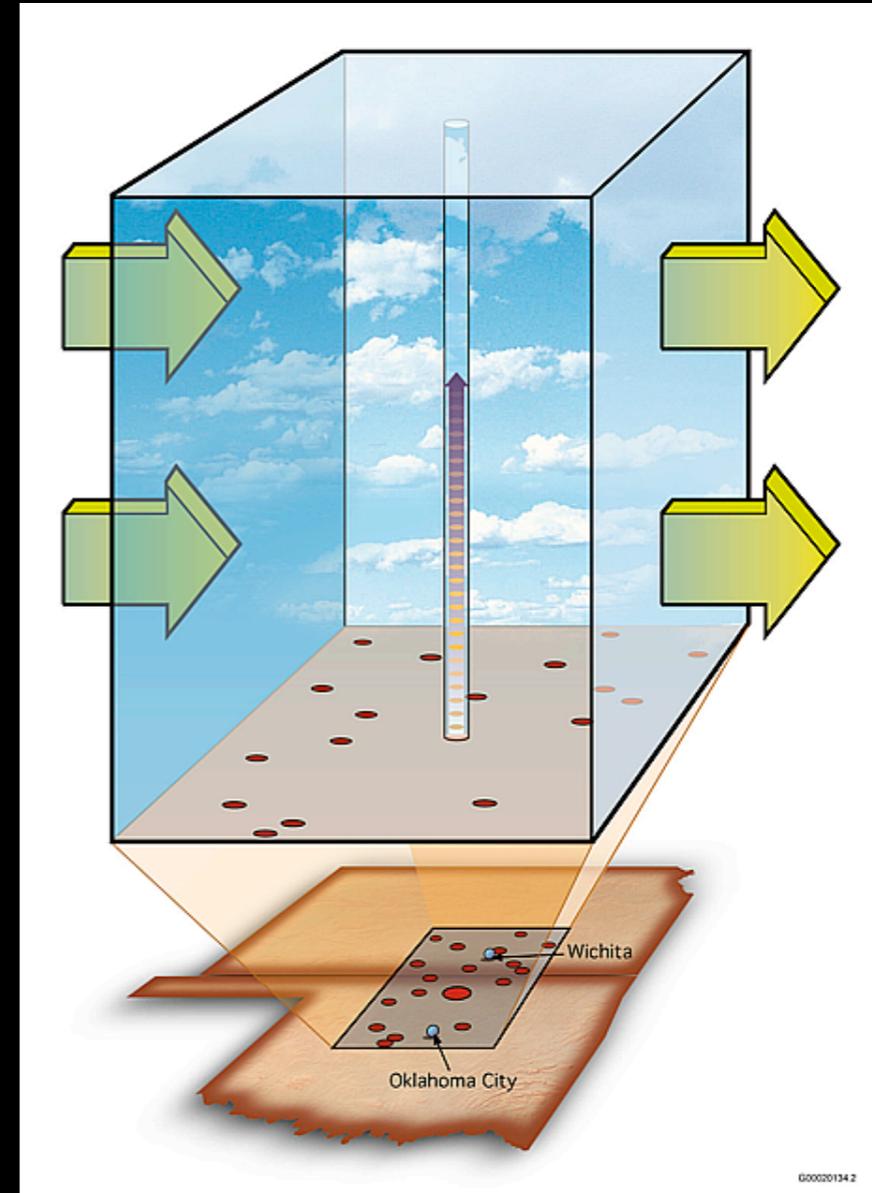
Measurement Approach

- Patterned after a single column model
- Detailed characterization of vertical column
- Spatial variations at the surface

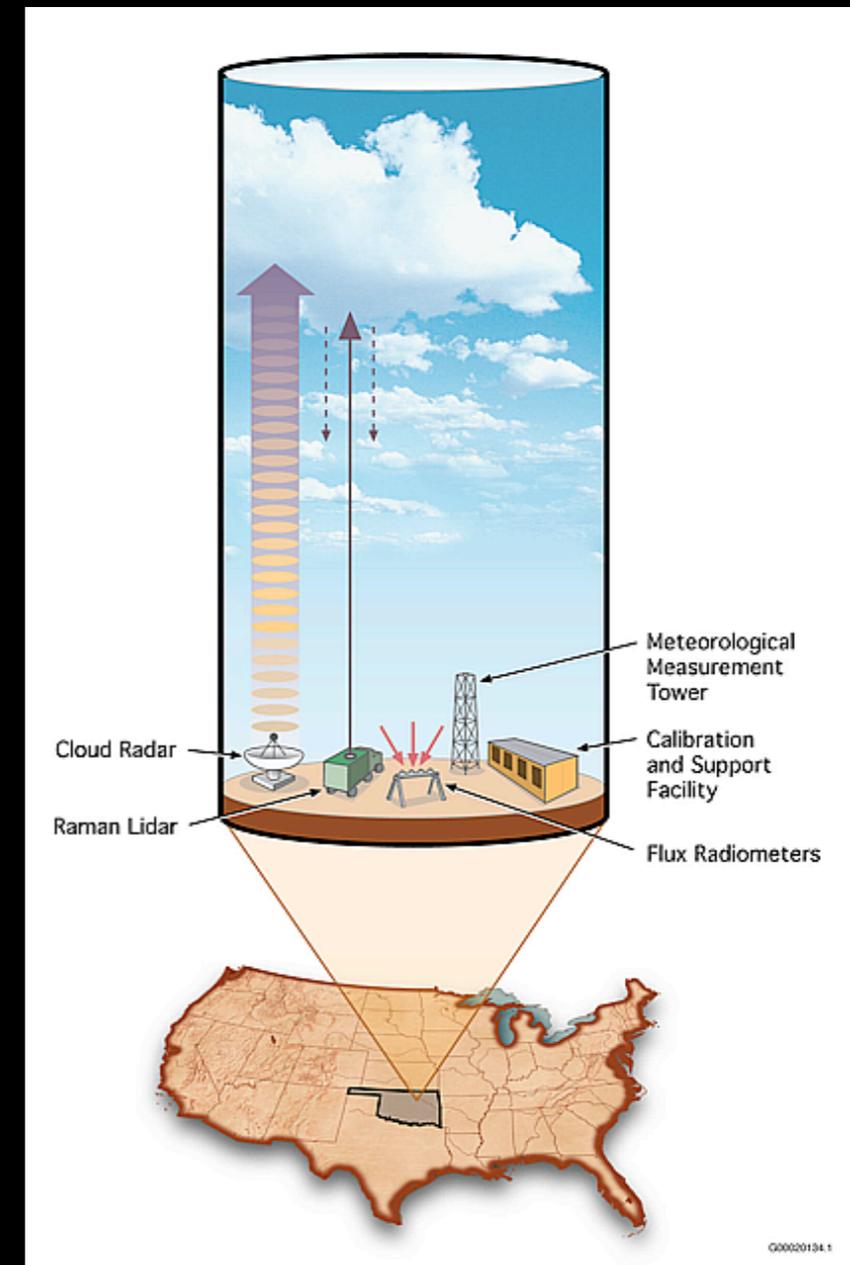


Measurement Approach

- Patterned after a single column model
- Detailed characterization of vertical column
- Spatial variations at the surface
- Transport of mass, momentum, and energy into and out of the domain

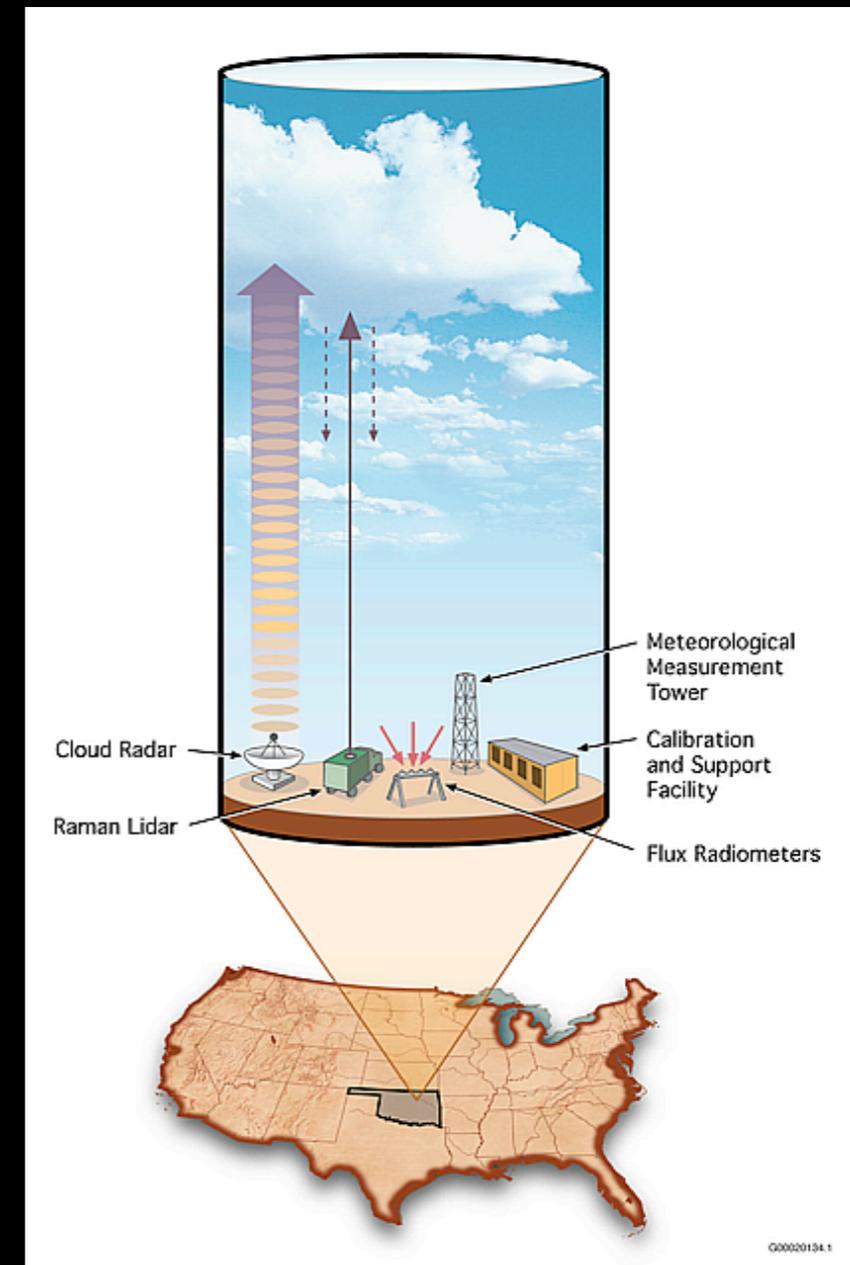


Instrument Approach



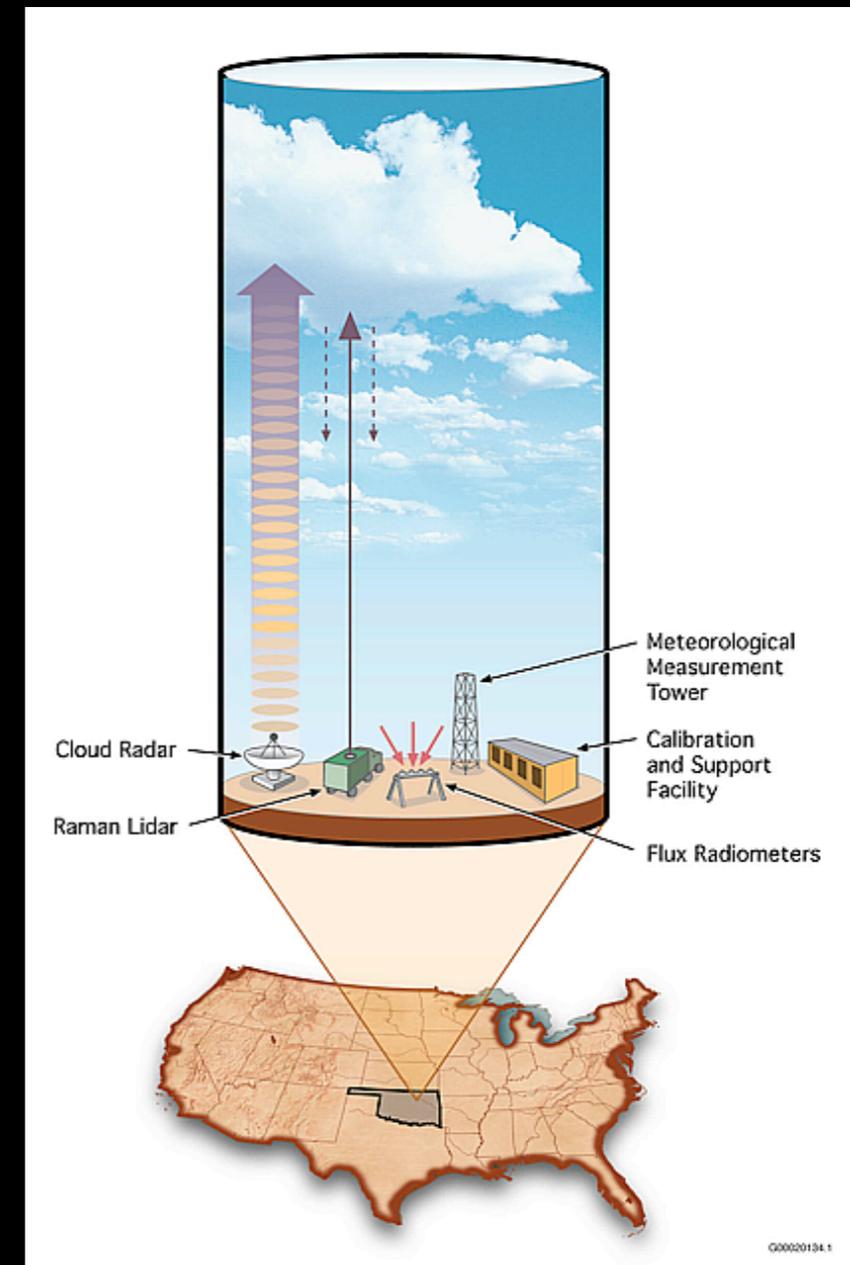
Instrument Approach

- Active Sensing



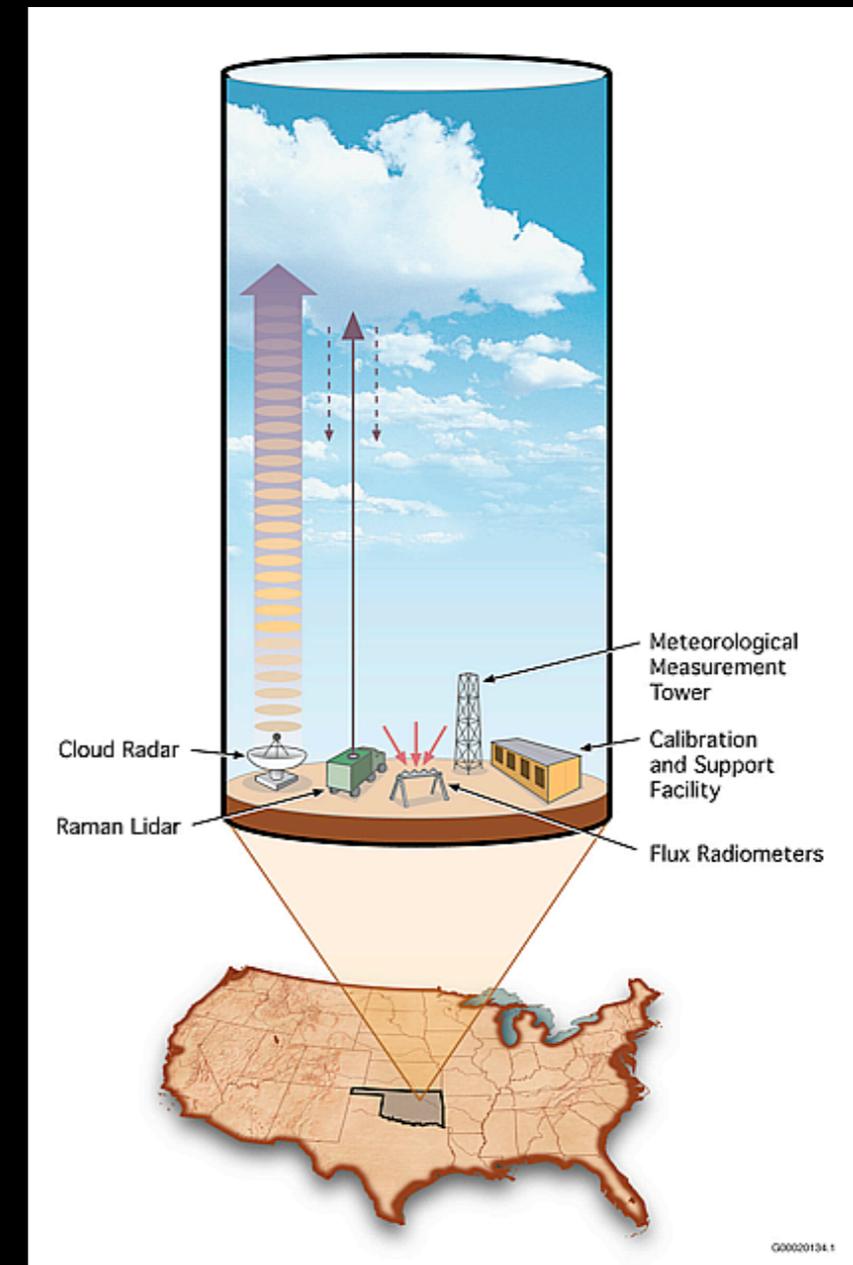
Instrument Approach

- Active Sensing
- Passive Sensing



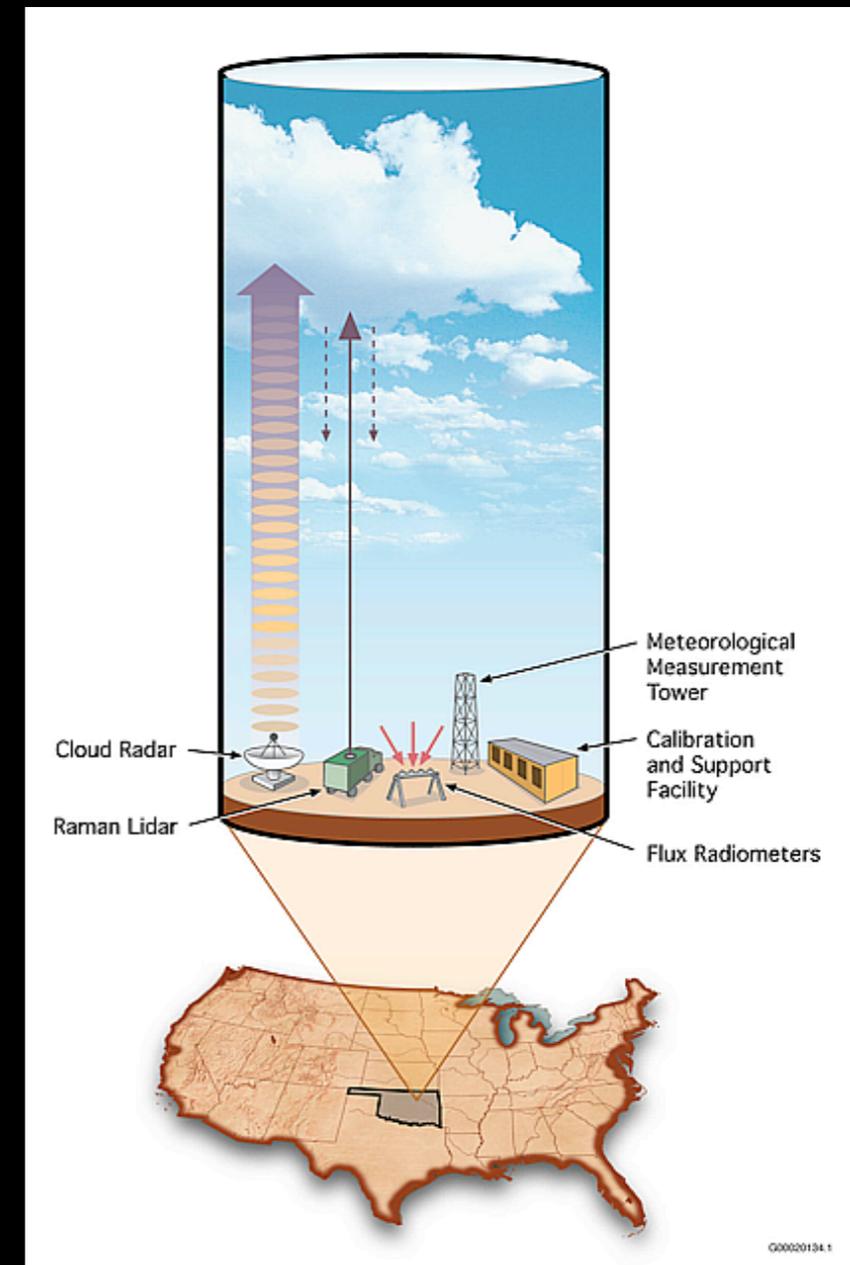
Instrument Approach

- Active Sensing
- Passive Sensing
- Maintenance and Calibration



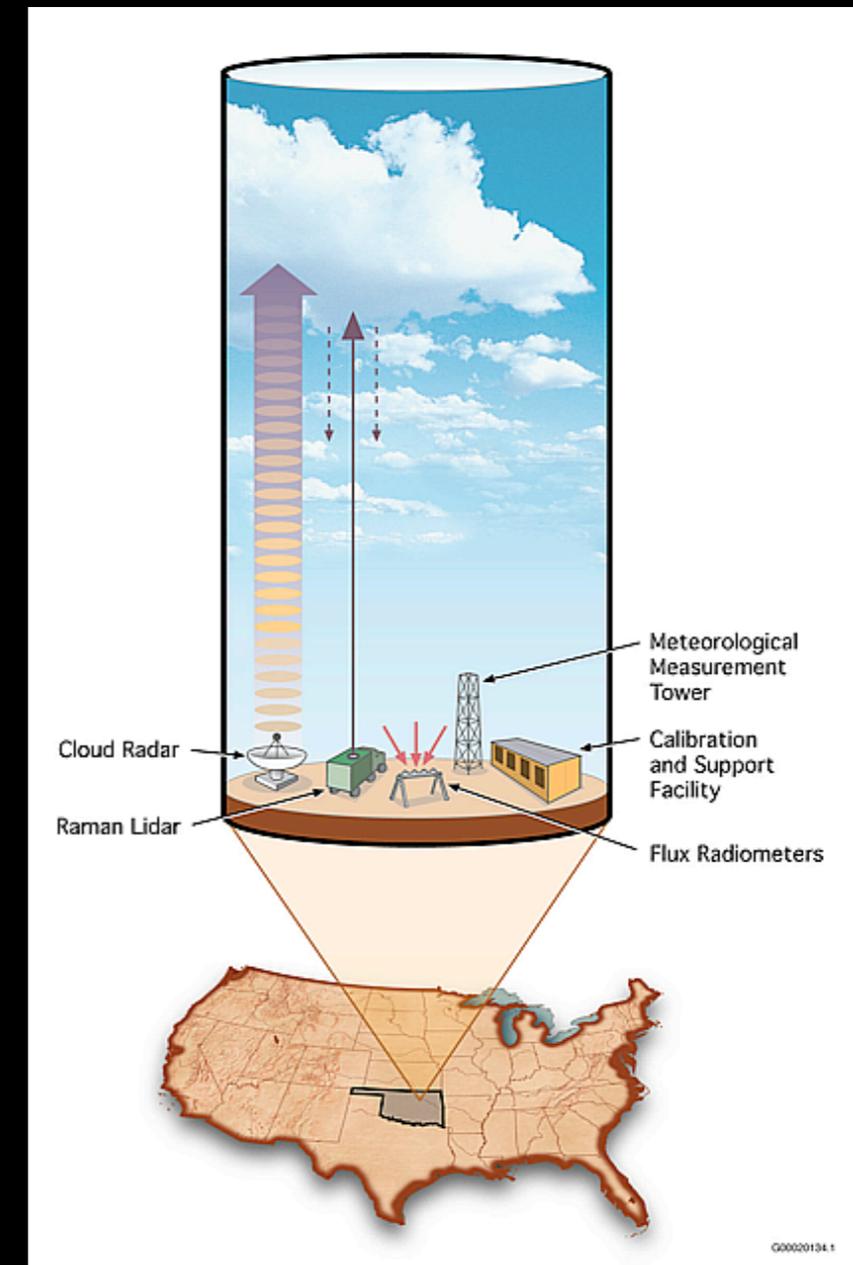
Instrument Approach

- Active Sensing
- Passive Sensing
- Maintenance and Calibration
- Research Site Operations



Instrument Approach

- Active Sensing
- Passive Sensing
- Maintenance and Calibration
- Research Site Operations
- Instrument Mentors



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Instrumentation



Instrumentation

- Deployment is driven by the science needs



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Instrumentation

- Deployment is driven by the science needs
- Coordinated to provide reliable, timely, high quality, and documented observations



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Instrumentation

- Deployment is driven by the science needs
- Coordinated to provide reliable, timely, high quality, and documented observations
- The resulting data products are available from the ARM Archive



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Instrumentation

- Deployment is driven by the science needs
- Coordinated to provide reliable, timely, high quality, and documented observations
- The resulting data products are available from the ARM Archive
- Instrument management is a cooperative effort



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Instrumentation ₂



Instrumentation ²

- Annual process in our science working groups to refine approach



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Instrumentation ²

- Annual process in our science working groups to refine approach
- Instruments are Grouped by Categories



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Instrumentation ²

- Aerosols

- Annual process in our science working groups to refine approach
- Instruments are Grouped by Categories



Instrumentation ²

- Annual process in our science working groups to refine approach
- Instruments are Grouped by Categories
 - Aerosols
 - Airborne Observations



Instrumentation ²

- Annual process in our science working groups to refine approach
- Instruments are Grouped by Categories
 - Aerosols
 - Airborne Observations
 - Atmospheric Carbon



Instrumentation ²

- Annual process in our science working groups to refine approach
- Instruments are Grouped by Categories
 - Aerosols
 - Airborne Observations
 - Atmospheric Carbon
 - Atmospheric Profiling



Instrumentation ²

- Annual process in our science working groups to refine approach
- Instruments are Grouped by Categories
 - Aerosols
 - Airborne Observations
 - Atmospheric Carbon
 - Atmospheric Profiling
 - Cloud Properties



Instrumentation ²

- Annual process in our science working groups to refine approach
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 - Airborne Observations
 - Atmospheric Carbon
 - Atmospheric Profiling
 - Cloud Properties
 - Radiometric



Instrumentation ²

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 - Aerosols
 - Airborne Observations
 - Atmospheric Carbon
 - Atmospheric Profiling
 - Cloud Properties
 - Radiometric
 - Surface Meteorology



Instrumentation ²

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- Instruments are Grouped by Categories
 - Aerosols
 - Airborne Observations
 - Atmospheric Carbon
 - Atmospheric Profiling
 - Cloud Properties
 - Radiometric
 - Surface Meteorology
 - Surface/Subsurface Properties



Instrumentation ³



Instrumentation ³

New instrument
capability in queue
for FY2009



Instrumentation ³

New instrument
capability in queue
for FY2009

- Add scanning capability to the 95 GHz Radar



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Instrumentation ³

New instrument
capability in queue
for FY2009

- Add scanning capability to the 95 GHz Radar
- Deploy next generation Microwave Radiometers



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Instrumentation ³

New instrument
capability in queue
for FY2009

- Add scanning capability to the 95 GHz Radar
- Deploy next generation Microwave Radiometers
- Refurbish the Rotating Shadowband Spectrometer



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Instrumentation ³

New instrument
capability in queue
for FY2009

- Add scanning capability to the 95 GHz Radar
- Deploy next generation Microwave Radiometers
- Refurbish the Rotating Shadowband Spectrometer
- Add Aerodynamic Particle Sizer



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Instrumentation ³

New instrument capability in queue for FY2009

- Add scanning capability to the 95 GHz Radar
- Deploy next generation Microwave Radiometers
- Refurbish the Rotating Shadowband Spectrometer
- Add Aerodynamic Particle Sizer
- Add Photo-Acoustic Spectrometer



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Instrument Team



Instrument Team

- All of our Instruments have a Mentor



Instrument Team

- All of our Instruments have a Mentor
- Technical point of contact



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Instrument Team

- All of our Instruments have a Mentor
- Technical point of contact
- New Instrument specifications



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Instrument Team

- All of our Instruments have a Mentor
- Technical point of contact
- New Instrument specifications
- Calibration protocol



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Instrument Team

- All of our Instruments have a Mentor
- Technical point of contact
- New Instrument specifications
- Calibration protocol
- Engineering, deployment, operations and maintenance



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Instrument Team

- All of our Instruments have a Mentor
- Technical point of contact
- New Instrument specifications
- Calibration protocol
- Engineering, deployment, operations and maintenance
- Data quality review



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Instrument Team ₂



Instrument Team ₂

- Documentation for data consumers



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Instrument Team ²

- Documentation for data consumers
- Consulting for data and instrument questions



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Instrument Team ²

- Documentation for data consumers
- Consulting for data and instrument questions
- Represent Instruments within the science community



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Presentation Outline

- Program Science Goals and Approach
- Research Sites
- Instrument Strategy
- Instrumentation
- Instrument Team
- Instrument Documentation
- Conclusion



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Instrument Documentation



Instrument Documentation

- Instrument Website www.arm.gov/instruments



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Instrument Documentation

- Instrument Website www.arm.gov/instruments
- Measurements Taken



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Instrument Documentation

- Instrument Website www.arm.gov/instruments
 - Measurements Taken
 - Categories, Location Table, Data Ordering



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Instrument Documentation

- Instrument Website www.arm.gov/instruments
 - Measurements Taken
 - Categories, Location Table, Data Ordering
 - Contacts, Data Quality Assessment



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Instrument Documentation

- Instrument Website www.arm.gov/instruments
 - Measurements Taken
 - Categories, Location Table, Data Ordering
 - Contacts, Data Quality Assessment
 - Monthly Reports



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Instrument Documentation

- Instrument Website www.arm.gov/instruments
 - Measurements Taken
 - Categories, Location Table, Data Ordering
 - Contacts, Data Quality Assessment
 - Monthly Reports
 - Instrument Handbook and File Header Descriptions



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Instrument Documentation ²

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ARM Instruments | External Instruments | Field Campaign Instruments | Location Table | Contacts



Millimeter Wavelength Cloud Radar (MMCR)

Instrument Categories: [Cloud Properties](#)

General Overview

The MMCR systems probe the extent and composition of clouds at millimeter wavelengths. The MMCR is a zenith-pointing radar that operates at a frequency of 35 GHz. The main purpose of this radar is to determine cloud boundaries (e.g., cloud bottoms and tops). This radar will also report radar reflectivity (dBZ) of the atmosphere up to 20 km. The radar possesses a doppler capability that will allow the measurement of cloud constituent vertical velocities.

Primary Measurements Taken

The following measurements are those considered scientifically relevant. Refer to the [netCDF File Header Descriptions](#) (Data Object Design Files) for the list of all available measurements, including those recorded for diagnostic or quality assurance purposes.

- [Horizontal wind](#)
- [Radar Doppler](#)
- [Radar reflectivity](#)
- [Vertical velocity](#)



Order Data

BUILD AN ORDER 

Or use the [datastream interface](#) at the ARM Archive.

Documentation

-  [MMCR Handbook](#) (PDF)
- [Instrument Mentor Monthly Summary \(IMMS\) reports](#)
- [MMCR Data Quality Assessment \(DQA\) reports](#)
- [MMCR netCDF File Header Descriptions](#) (Data Object Design Files)

Questions? Comments?

We would love to hear from you!
[Contact us](#) or call 1-888-ARM-DATA.



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- Instrument Mentors www.arm.gov/instruments/mentors.php



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- Data Quality dq.arm.gov



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- Instrument Coordinator
jimmy.voyles@arm.gov



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- Thank You !



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