Atmospheric Radiation Measurements – ARM

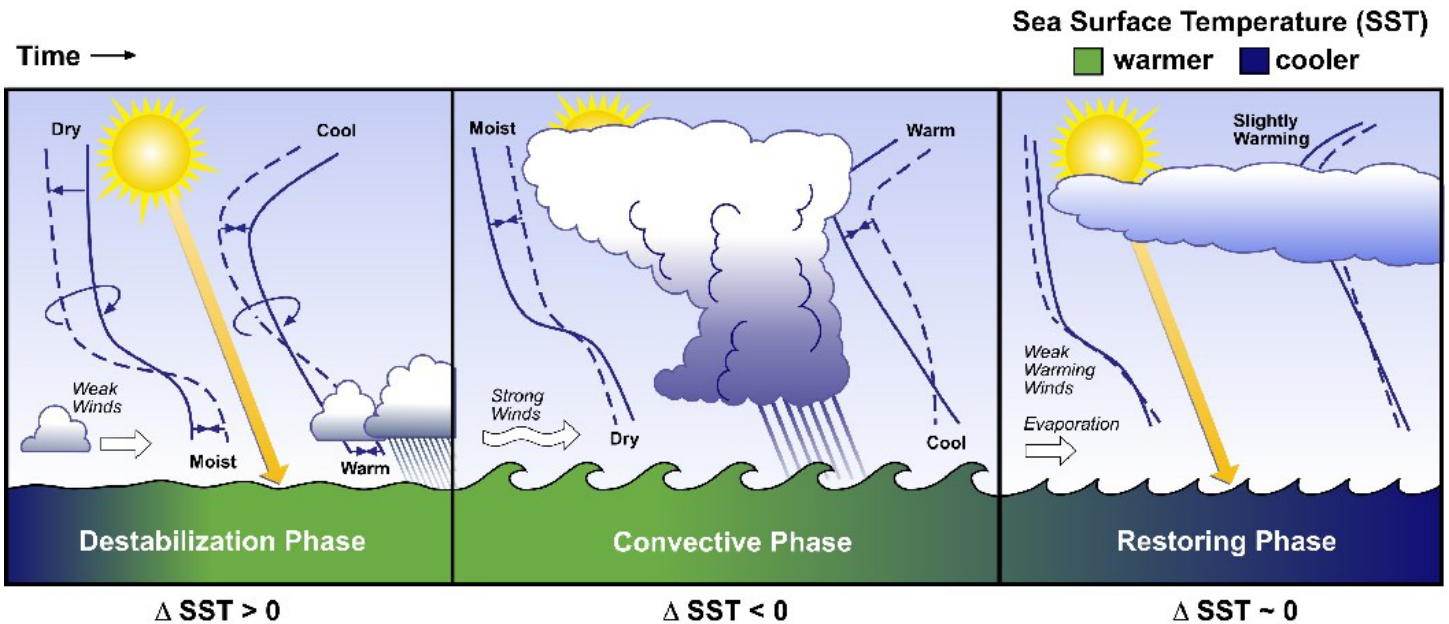
Jeff Gaffney

Atmospheric Radiation Measurement
Climate Research Facility

A National User Facility
for the Scientific Community

http://www.arm.gov

The primary goal of the ARM Program is to improve the treatment of cloud and radiation physics in global climate models in order to improve the climate simulation capabilities of these models.



Atmospheric
Radiation
Measurement
Climate Research Facility

A National User Facility
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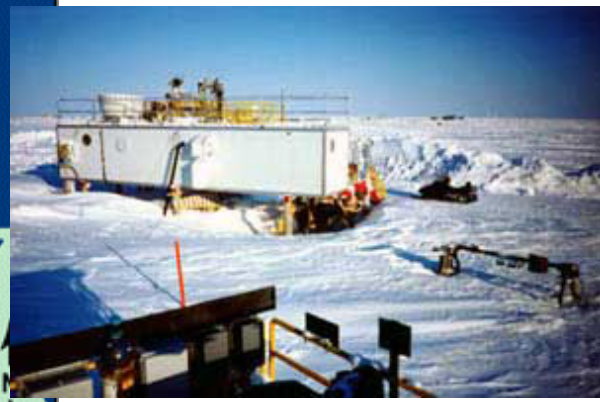
Mission Statement

The U.S. Department of Energy's (DOE's) ARM Climate Research Facility (ACRF) has been designated a national user facility for the purpose of providing this unique asset for the study of global change to the broader national and international research community. Research at this facility will include the study of alterations in climate, land productivity, oceans or other water resources, atmospheric chemistry, and ecological systems that may alter the capacity of the Earth to sustain life. Global change research also includes the study, monitoring, assessment, prediction, and information management activities to describe and understand:

- The interactive physical, chemical, and biological processes that regulate the total Earth system
- The unique environment that the Earth provides for life
- The changes that are occurring in the Earth system and the environment and how these changes are influenced by human actions.

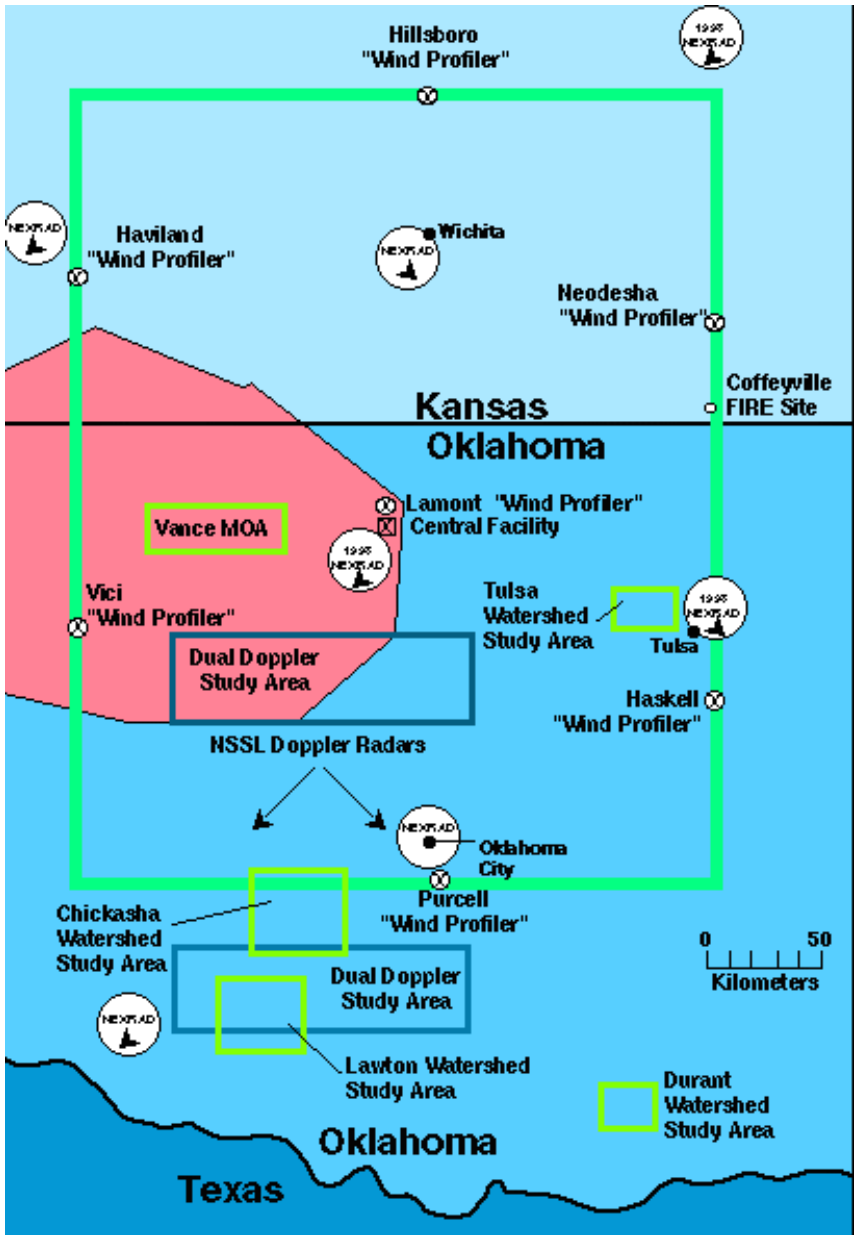
North Slope
Alaska Region
Southern Great
Plains Region
Tropical Western
Pacific Region

Chukchi Sea
North Salt Lagoon
Middle Salt Lagoon
Brant Point
ARM Site
ARM Duplex
Barrow
Stevens St.
Gas Field Rd.
Airport
Footprint Lake

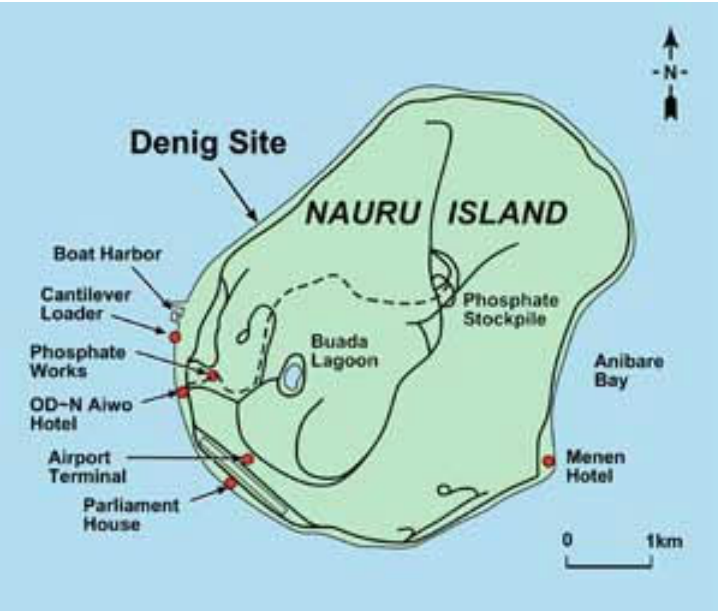


N
Meade River
Atqasuk
ARM Site
Airport

Southern Great Plains Research Site

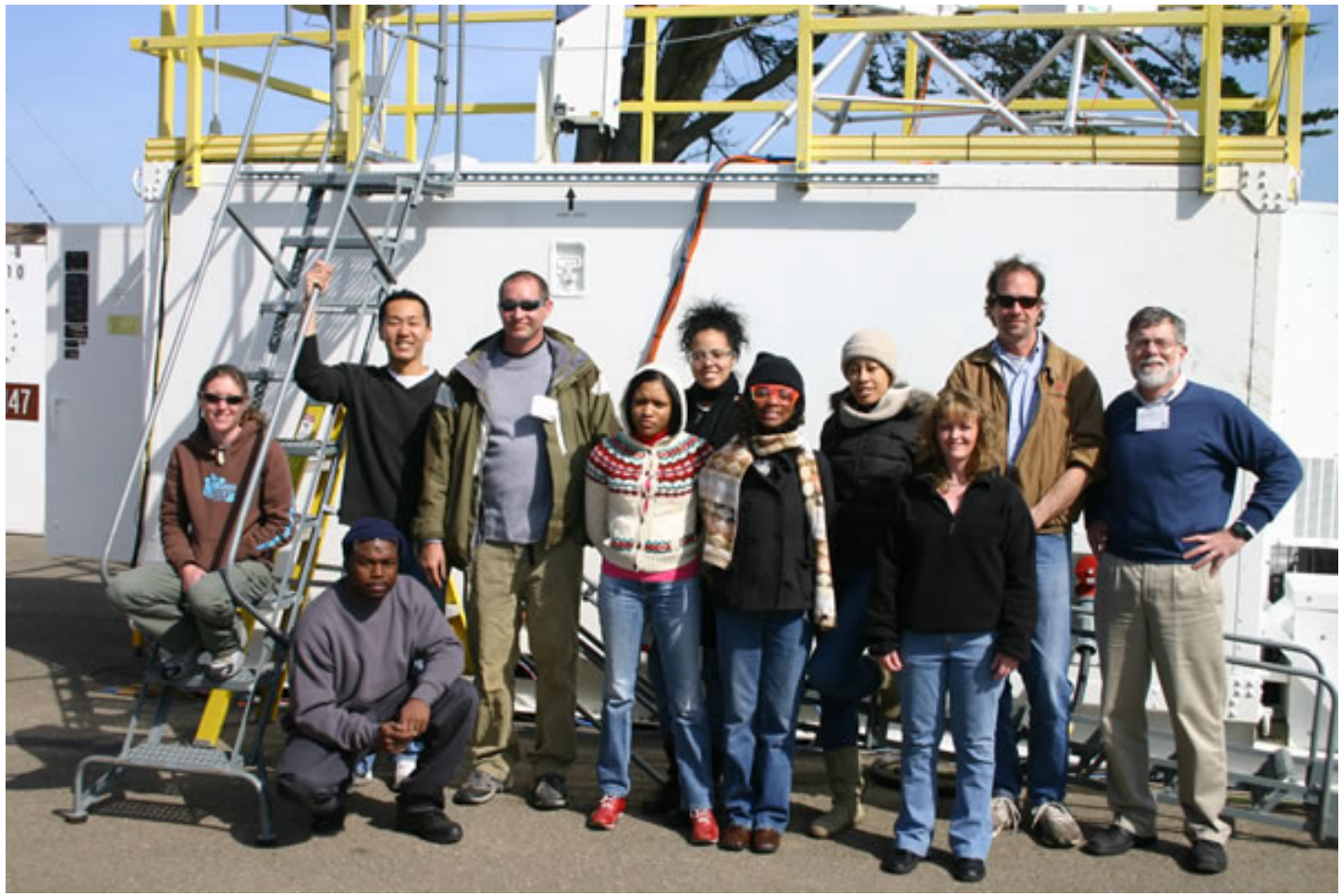


Tropical Western Pacific



MOBILE FACILITY… more on that later

POINT REYES - California



ARM INSTRUMENTATION…..

Measurement Categories

- Shortwave Spectral Radiation
- Cloud Properties
- Surface Meteorology
- Atmospheric Profiling
- Surface Energy Flux
- Aerosols
- Atmospheric Carbon
- Airborne Platforms
- Longwave Spectral Radiation
- Longwave Broadband Radiation
- Shortwave Broadband Radiation
- Retired Instruments

Shortwave Spectral Radiation

Radiometric measurements provide data on the propagation of electromagnetic energy through the atmosphere. These types of measurements represent the majority of ARM data, and are obtained using various types of active (such as radar and lidar) and passive (such as broadband radiometers and spectral sensors) sensors.

- Absolute Solar Transmittance Interferometer (ASTI)
- Baseline Solar Radiation Network (BRS)
- Cimel Sunphotometer (CSPHOT)
- Multifilter Radiometer (MFR)
- Multifilter Rotating Shadowband Radiometer (MFRSR)
- Narrow Field of View (NFOV)
- Normal Incidence Multifilter Radiometer (NIMFR)
- Rotating Shadowband Spectrometer (RSS)
- Shortwave Spectrometer (SWS)
- Solar Radiance Transmission Interferometer (SORTI)

Cloud Properties

Active and passive remote sensing instruments are used to measure the macroscopic properties (horizontal and vertical distributions) of clouds, and the microphysical properties (sizes, shapes, and phases [water or ice]) of the particles that comprise the clouds.

- Belfort Laser Ceilometer (BLC)
- Micropulse Lidar (MPL)
- Microwave Radiometer (MWR)
- Microwave Radiometer Profiler (MWRP)
- Millimeter-Wavelength Cloud Radar (MMCR)
- Narrow Field of View (NFOV)
- Raman Lidar (RL)
- Total Sky Imager (TSI)
- Vaisala Ceilometer (VCEIL)
- Video Time-Lapsed Camera (VTLC)
- Whole Sky Imager (WSI)

MULTI-FILTER ROTATING SHADOW BAND RADIOMETER

METEOROLOGY

Measurements

LOTS OF DATA!

Datastreams by Measurement Category

Shortwave Spectral Radiation

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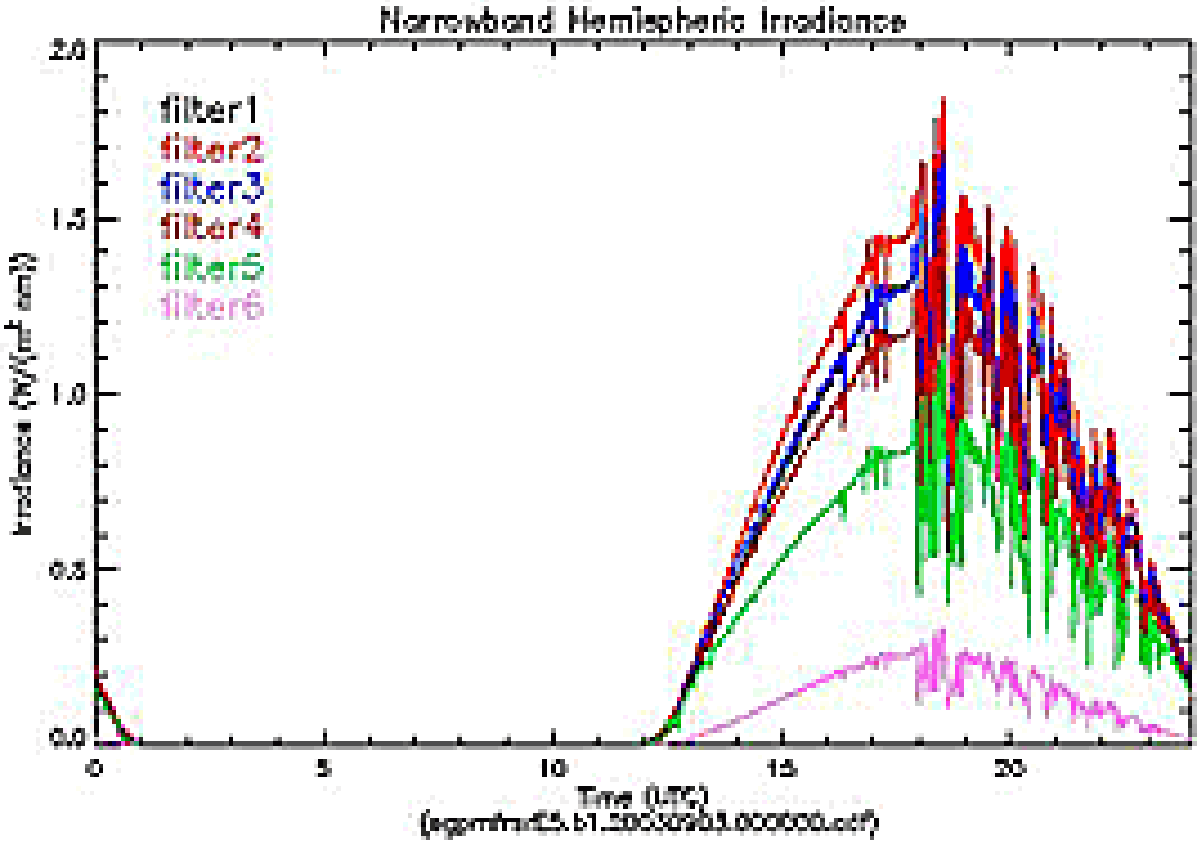
- brs
- brs20s
- mfr10m
- mfr25m
- mfrsr
- nfov
- nfov2ch
- nimfr



RAW DATA – Quality Assured and Archived – Daily

FOR ALL SITES..

HUGE DATA SETS…

SOME EXAMPLES OF ARM SCIENCE…

•Dr. Bruce Albrecht, University of Miami, and Dr. Pavlos Kollias, NOAA/CIRES/ETL: "Development and Evaluation of Boundary Layer Cloudiness Parameterization Using ARM Observations"
•*NEW*-Drs. Richard Austin and Graeme Stephens, Colorado State University: "Operational Retrieval of Cloud Microphysical Properties Using Combined Measurements by Diverse Instruments"
•*NEW*-Dr. Howard Barker, Meteorological Service of Canada: "Advancing the Representation of Radiative Transfer for Cloudy Atmospheres in Global Climate Models"
•*NEW*-Dr. Larry Berg, Pacific Northwest National Laboratory: "Development, Evaluation, and Application of New Parameterization Framework for Boundary-Layer Cumuli"
•*NEW*- Dr. Christopher Bretherton, University of Washington: "ARM-based Development of a New Combined Parameterization for Shallow and Deep Cumulus Convection in Large-Scale Climate Models"
•*NEW*-Dr. Jennifer Comstock, Pacific Northwest National Laboratory, and Dr. Ruei-Fong Lin, NASA/Goddard Space Flight Center: "Investigation of High Ice Supersaturation in Cirrus Clouds Using ARM Measurements and an Explicit Cloud Model"

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