ATMOSPHERIC RADIATION MEASUREMENT

PURPOSE

A scientific user facility that provides researchers with strategically located atmospheric observatories. The resulting data are used to improve the understanding of how the Earth's atmosphere works and the way those processes are represented in regional and global models.

SPONSOR

U.S. Department of Energy (DOE) Office of Science

PARTNERS

Operated by 9 DOE national laboratories, the ARM user facility works together with numerous government agencies, universities, private companies, and foreign organizations.

FACTS

- 3 fixed atmospheric observatories – Oklahoma, Alaska, and the Azores
- 3 mobile facilities – deployed to sites ranging from the Amazon to Antarctica
- Aerial facilities – 1 Bombardier Challenger 850 regional jet, 1 ArcticShark uncrewed aerial system, and tethered balloons
- 3+ petabytes of stored data archived in the ARM Data Center
- ~25 years of atmospheric observations in the Arctic
- 30 years of data with the world's oldest and largest atmospheric research facility in the Southern Great Plains
- ~1,000 average registered scientific users annually
- 460+ instruments in total collect massive amounts of climate data
- 4,000+ journal articles related to ARM since 1990

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Atmospheric Radiation Measurement (ARM) User Facility

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

What affects where and how hard it rains? What impact do clouds have on the radiant energy coming from the sun? What role do tiny particles in the air play in forming clouds?

It is basic science questions like these that researchers are answering using data from the Atmospheric Radiation Measurement (ARM) user facility.

ARM, a multi-laboratory, U.S. Department of Energy (DOE) Office of Science user facility, has collected data around the world for 30 years. In addition to advancing scientists' understanding of how the atmosphere works, ARM data are being used to improve the representation of clouds, aerosols, and their interactions with Earth's radiant energy in earth system models. Better models improve the accuracy of long-term climate forecasts and help our nation develop sustainable solutions to energy and environmental challenges.

Scientific Impact

ARM was the first atmospheric research program to deploy a comprehensive suite of cutting-edge instruments to continually measure cloud and aerosol properties and their impacts on Earth's energy balance. This strategy revolutionized scientists' ability to collect long-term statistics of detailed cloud properties and now serves as a model for similar programs around the world.

Since 1992, data collected by the ARM user facility in diverse climates have yielded insights into a range of scientific issues, including measuring absorption of radiation (energy) from the sun by clouds and water vapor, identifying factors that trigger cloud formation, and detailing the characteristics of aerosol and cloud properties, such as

ice crystal sizes. Observations have led to greatly improved techniques for measuring cloud properties from the ground, which reveal ways to enhance the representation of clouds in earth system models.

Atmospheric Observatories

ARM operates heavily instrumented fixed-location atmospheric observatories in Oklahoma, Alaska, and the Azores. In addition, ARM offers scientists the use of mobile, relocatable observatories, as well as crewed and uncrewed aerial facilities.

Scientists from around the world conduct research using freely available data from ARM's continuous measurements and field research campaigns. Any scientist can submit a proposal to conduct field campaigns using ARM's observatories.

Modeling Capability

Computational modeling is a newer ARM capability. To speed the ability of regional and global modelers to effectively use ARM data, routine modeling efforts have been developed that:

- Use large-eddy simulation (LES) models to better tie together ARM observations and earth system models
- Support the study of atmospheric processes
- Improve the representation of clouds, aerosols, and the Earth's energy balance in regional and global models.

ARM Provides

- **Data** – Access 30 years of atmospheric data gathered during normal operations and field campaigns
- **Instruments** – Explore over 460 instruments that collect data at locales spanning diverse meteorological regimes
- **Campaigns** – Conduct atmospheric and climate science in strategic locations around the world
- **Models** – Retrieve large-eddy simulation modeling data, simulations, and analysis tools
- **Publications** – Discover ARM-related research on clouds and aerosols, their interaction with the Earth's energy balance, and representation in earth system models.

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