

U.S. Department of Energy Atmospheric Radiation Measurement Program



The Atmospheric Radiation Measurement (ARM) Program is the largest global change research program supported by the U.S. Department of Energy (DOE). It was created in 1989 as part of the U.S. Global Change Research Program to help resolve scientific uncertainties related to global climate change, with a specific focus on the crucial role of clouds and their influence on radiative feedback processes in the atmosphere. The primary goal of the ARM Program is to improve the treatment of cloud and radiation physics in global climate models. ARM's scientists research a broad range of issues that span remote sensing, physical process investigation, and modeling on all scales. ARM's site operators focus on obtaining continuous field measurements and providing data products to promote the advancement of climate models.

Significant features and milestones of the ARM Program include the following:

- The ARM Program is one element of a coordinated DOE effort to resolve scientific uncertainties about potential global climate change. Related DOE programs address atmospheric aerosol and related chemistry, ecosystem response, ocean effects, terrestrial carbon processes, climate prediction, global climate change education, information integration, and integrated assessment modeling.
- Science Working Groups and the Science Team Executive Committee set the ongoing research agenda for ARM. Operations and Data Systems groups support this agenda through development of instruments and data systems as well as management of ARM research sites and the ARM Mobile Facility.
- The first field measurement site, located in the U.S. Southern Great Plains (SGP), began to acquire science data in 1994. This site covers approximately 143,000 square kilometers (55,000 square miles) in north-central Oklahoma and south-central Kansas. The site consists of a heavily instrumented Central Facility—about 64 hectares (160 acres)—and a network of smaller sites with limited instruments spread over the larger area.



- The second site, located in the Tropical Western Pacific (TWP) locale, was commissioned in September 1996, when an instrument suite was installed on Manus Island in Papua, New Guinea. A second instrument set was installed on Nauru in 1998. A third instrument set was installed at Darwin, Australia, in 2002. The TWP locale lies roughly in the area between 10°N and 10°S of the equator from 120°E to 180°E longitude.
- The North Slope of Alaska (NSA) locale has been operational since 1997. The main cluster of instruments is installed near Barrow, Alaska, while a smaller instrument array, installed in 1999, is located to the south near the village of Atkasuk.
- Data from the permanent and mobile sites have been collected on a continuous basis for more than 10



years. The ARM Archive provides all data through a website at no cost to the requestor. Since its inception in June 1992, the ARM Archive has collected about 49 terabytes of data in more than 7 million files, with more arriving daily. Archive users retrieve 200,000 to 300,000 data files per month from the stored file location.

- An ARM Mobile Facility (AMF) was designed to explore science questions beyond those addressed at the current fixed sites. With instrumentation and data systems similar to these sites, the AMF will deploy to sites around the world for durations of up to 12 months.
- Field campaigns are conducted to address specific science questions that require additional data. The data are obtained through enhancement of the normal operational mode of ARM instruments or the temporary addition of ground-based and in situ instruments.
- Data from ARM sites are greatly increased during field campaigns, when measurements are taken more frequently, and additional instruments are often added to the site's instrument suite. These field campaigns are executed in response to the scientific needs of the program. For example,

field campaigns at the SGP site have helped evaluate new advanced remote sensors, such as high-resolution spectral radiometers, lidar, and radar. These sensors have been incorporated into the routine observational schemes of all three sites as appropriate.

- ARM Program researchers come from DOE laboratories, universities, other federal laboratories, and private agencies, and include international participants.
- ARM collaborates extensively with the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and other agencies. International collaborations include the Global Ocean-Atmosphere-Land System (GOALS) and Global Energy and Water Experiment (GEWEX), both elements of the World Climate Research Programme. These collaborations help optimize the acquisition, distribution, and use of data from state-of-the-art ground, airborne, and satellite instruments.

The data- and model-testing capabilities, provided through ARM, will contribute significantly to improvements in global climate models and weather forecasting models. Ultimately, ARM research is intended to improve predictions of how the earth's climate will change, how fast the change will occur, and what the regional effects of that change will be. This information is needed by national and world leaders to make energy and economic policy decisions.

For more information, contact:

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