ARM
CLIMATE RESEARCH FACILITY

FACT SHEET

U.S. Department of Energy

ARM Aerial Facility

As an integral measurement capability of the ARM Climate Research Facility, the ARM Aerial Facility (AAF) provides airborne measurements required to answer science questions proposed by the international research community. Ground-based instrumentation at the ARM sites provides a unique and continuous record of the components of the atmospheric state and constituents that impact the surface radiation budget. The AAF enhances the utility and information content of long-term ground-based measurements by providing:

- in situ measurements of cloud properties for evaluating and improving ground-based remote sensing retrievals,
- critical data for scaling ground-based remote sensing retrievals to larger temporal and spatial scales detected by satellites, and
- aircraft measurements of clouds, aerosols, and radiation for testing and evaluating high-resolution models and model parameterizations.

Facilities and Resources

The AAF supports routine airborne observations and participates in field campaigns designed to contribute to the fundamental understanding of clouds, aerosols, and radiation. To ensure that the best airborne data set can be obtained for a given campaign or routine airborne observational time period, the AAF continually assesses the capabilities of existing instruments and instruments under development within the airborne measurement community. New instruments are integrated into the AAF suite to fill current measurement gaps, as needed.

Working with instrument developers from national laboratories, universities, and private industry, the AAF takes an active role in new instrument development, particularly in the area of miniaturization, where existing instrumentation is merged with new technology to better fit into a space/weight-constrained airborne platform.

Research aircraft are selected and commissioned to address the wide range of airborne measurement requirements associated with atmospheric science issues. Aircraft choice for a given campaign or routine observational time period is dictated by science requirements—such as the required measurements and desired flight profile—and aircraft availability. As flight missions are identified, a risk evaluation is performed to ensure that the aircraft and mission meet all U.S. Department of Energy aviation policy guidelines and safety protocols. Data obtained from the aircraft are documented, checked for quality, integrated into the ARM Data Archive, and made available in a timely and consistent manner for use by the scientific community through the ARM Data Archive website, ***www.archive.arm.gov.***

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The use of unmanned aerial systems is becoming increasingly popular among atmospheric researchers. These systems provide revolutionary scientific information through the routine measurement of atmospheric conditions, particularly properties related to clouds, aerosols, and radiation in locations not easily accessible by manned aircraft. For instance, the recent campaign Evaluation of Routine Atmospheric Sounding Measurements using Unmanned Systems (ERASMUS) was designed to demonstrate how small, low-cost, unmanned aerial systems can be used to study and measure these clouds and aerosols in the cold and harsh arctic atmosphere.

Field Campaigns

The AAF provides aerial measurement platforms that can be used to support experiments at the fixed sites, in conjunction with a mobile facility, or in support of other research activities, such as maturation/hardening of instruments. Use of the aircraft and instruments must be requested through the ARM field campaign process. To learn more about the proposal process for field campaigns involving the AAF, go to ***www.arm.gov/sites/aaf***.

Examples

Biomass Burning Observation Project (2013)

Plants, trees, grass, brush, and moss are all consumed as fuel in the tempest of the many fires that dot the United States every year. While many studies on the plumes of such fires have been done in tropical climates (e.g., Brazil, sub-Saharan Africa), relatively few studies have been conducted in the United States. Each year, acres of biomass burned across the country produce soot and a kaleidoscope of chemical aerosols that have an impact on climate. To better understand how these aerosols affect Earth's atmosphere and climate, scientists sent the Gulfstream-1 research aircraft into the smoke-filled skies from June through October 2013 over the Pacific Northwest and Mid-South regions.

Green Ocean Amazon (2014-2015)

Tropical deep convection in its natural state and the underlying processes that drive it are poorly understood and modeled, with insufficient observational data sets for model constraint. The AAF Gulfstream-1 was deployed to Brazil in two phases to obtain measurements of cloud, trace gas, and aerosol properties. Phase I took place February 16 to March 27, 2014, and Phase II took place September 1 to October 10, 2014. The Gulfstream-1 flew vertical profiles to an altitude of 5 to 6 kilometers to determine changes to gases and particles within the detrainment levels of shallow cumulus clouds, to investigate properties of polluted layers, and to characterize cloud dynamics, thermodynamics, and microphysics.

ARM Airborne Carbon Measurements V (2015)

Atmospheric temperatures are warming faster in the Arctic than predicted by climate models. The impact of this warming on permafrost degradation is not well understood, but it is projected to increase carbon decomposition and greenhouse gas production (carbon dioxide and/or methane) by arctic ecosystems. Airborne observations of atmospheric trace gases, clouds, aerosol, radiation, and cloud properties at the North Slope of Alaska are improving scientist's understanding of global climate, with the goal of reducing the uncertainty in global and regional climate simulations and projections. From June 1 through September 15, 2015, the AAF deployed

the Gulfstream-1 research aircraft to fly over the North Slope of Alaska to collect these measurements.

Evaluation of Routine Atmospheric Sounding Measurements using Unmanned Systems (2015-2016)

During two, two-week campaign periods in the summer 2015 and spring of 2016, ERASMUS will operate a variety of instrumented unmanned aerial systems to provide hard-to-gather data to ultimately improve climate models. These measurements will be complimentary to those concurrently obtained by the third ARM Mobile Facility ground instrumentation, deployed at the site, which give scientists expanded measurements to study arctic clouds, aerosols, and other atmospheric phenomena.

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www.arm.gov/sites/aaf

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