

FACT SHEET

U.S. Department of Energy Next Generation ARM to Improve Climate Modeling and Science

For more than 20 years, the Atmospheric Radiation Measurement (ARM) Climate Research Facility has blazed the trail in providing the world's atmospheric scientists with continuous observations of cloud and aerosol properties and their impacts on Earth's energy balance. The result is an unprecedented data set that has proved invaluable for understanding the atmosphere and improving the predictive capabilities of earth system models.

To create a powerful new capability for furthering ARM's mission, this U.S. Department of Energy (DOE) user facility is undergoing a reconfiguration that will provide even more complete data sets to support process studies and model development. The combined observational and modeling elements will enable a new level of scientific inquiry.

To achieve the vision established in its Decadal Vision, the next-generation ARM will:

- Establish observation-modeling “megsites” at its Southern Great Plains and North Slope of Alaska sites
- Enhance ARM measurement excellence to support DOE climate science research
- Produce routine high-resolution model simulations over domains coincident with ARM sites
- Develop data products and software tools that facilitate analysis and enable the evaluation of models using ARM data
- Strengthen interactions with the atmospheric science and modeling communities.

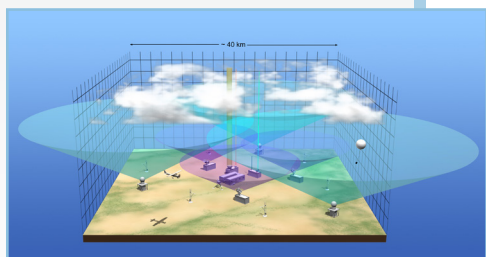
Enhancing Measurements and Modeling with Megsites

ARM's Southern Great Plains (SGP) site near Lamont, Oklahoma, and the North Slope of Alaska (NSA) site in Barrow, combined with the mobile facility at Oliktok Point, are undergoing enhancements to create “megsites.” Changes being implemented will provide additional spatial sampling of atmospheric and surface information to support a new ARM capability—the routine operation of high-resolution process-models. The result will be even more comprehensive scientific data and the processes and tools for scientists to more easily use the data for climate model development.

With substantial measurement capabilities, the SGP is already the world's largest and most extensive climate research field site. The newly reconfigured site will better address next-generation science questions about the complex interactions among atmospheric circulations, thermodynamics, aerosols, clouds, and the land surface.

Planned changes underway at the SGP site include:

- Enhanced routine measurements of atmospheric state profiles to facilitate the calculation of model forcing data sets
- Improved characterization of the land-atmosphere interface, particularly soil moisture
- Increased density of cloud measurements near the SGP Central Facility
- Enhanced information about the vertical profile of aerosols.



This illustration depicts the new Southern Great Plains megasite, incorporating a network of instruments to support model development and evaluation.



Changes at the Southern Great Plains will provide more complete data sets.



The North Slope of Alaska megasite will include new unmanned aerial system activities.

With the rapid changes in the Arctic environment, the North Slope of Alaska has become a focal point for atmospheric and ecological research. Since 1997, ARM has gathered climate data at its NSA site in Barrow, the northernmost city in the United States located on the edge of the Arctic Ocean. The ARM Facility began expanding its operations in the region in 2012 by locating its third mobile facility at Oliktok, which provides unique opportunities for operating unmanned aerial systems (UAS) and tethered balloon systems (TBS) for scientific research.

The NSA megasite is being enhanced in the near term through aerial measurements including missions using UAS, TBS, and the ARM Aerial Facility Gulfstream-1 (G-1) aircraft to better sample surface fluxes, atmospheric vertical structure, and aerosol and cloud properties.

New Capabilities

An important component of the next-generation ARM Facility will be routine model simulations and associated joint analysis with observations. Processes are being developed to use the enhanced data from the megasites to constrain a Large-Eddy Simulation (LES) model, a high-resolution mathematical model used to simulate atmospheric motions and cloud processes.

While this type of observation-model integration is not new at ARM sites, the creation of the two megasites will enable application of this observation-model synergy on a routine basis to better exploit the long-term nature of ARM observations.

The Facility will first set up this coupled observation-modeling framework at the Southern Great Plains site and is in the process of a two-year pilot study to develop the model configuration and workflow, as well as develop related data products to force and evaluate the simulations. The resulting library of routine high-resolution model simulations combined with the detailed ARM observations will provide powerful new research capabilities.



Routine LES modeling will add new research capabilities.

Additional Information

- ARM Decadal Vision
www.arm.gov/publications/programdocs/doe-sc-arm-14-029.pdf
- LES ARM Symbiotic Simulation and Observation (LASSO) Implementation Strategy
www.arm.gov/publications/programdocs/doe-sc-arm-15-039.pdf
- ARM Data Archive
www.archive.arm.gov

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