

## APPENDIX C

This appendix is the executive summary of the 2004 Atmospheric Radiation Measurement Program Science Plan: Current Status and Future Directions of the ARM Science Program (DOE/ER-ARM-0402; available online at <https://www.arm.gov/publications/programdocs/doe-er-arm-0402.pdf>) sponsored by the U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research. The text has been edited to conform to the style of the American Meteorological Society, but the content is otherwise unchanged from the original document.

### **Executive Summary: Atmospheric Radiation Measurement Program Science Plan: Current Status and Future Directions of the ARM Science Program**

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The Atmospheric Radiation Measurement (ARM) Program has matured into one of the key programs in the U.S. Climate Change Science Program. The ARM Program has achieved considerable scientific success in a broad range of activities, including site and instrument development, atmospheric radiative transfer, aerosol science, determination of cloud properties, cloud modeling, and cloud parameterization testing and development. The focus of ARM science has naturally shifted during the last few years to an increasing emphasis on modeling and parameterization studies to take advantage of the long time series of data now available.

During the next 5 years, the principal focus of the ARM science program will be to

- maintain the data record at the fixed ARM sites for at least the next five years;
- improve significantly our understanding of and ability to parameterize the 3D cloud radiation problem at scales from the local atmospheric column to the global climate model (GCM) grid square;
- continue developing techniques to retrieve the properties of all clouds, with a special focus on ice clouds and mixed-phase clouds;
- develop a focused research effort on the indirect aerosol problem that spans observations, physical models, and climate model parameterizations;
- implement and evaluate an operational methodology to calculate broadband heating rates in the atmospheric columns at the ARM sites;
- develop and implement methodologies to use ARM data more effectively to test atmospheric models, both at the cloud-resolving model scale and the GCM scale;
- use these methodologies to diagnose cloud parameterization performance and then refine these parameterizations to improve the accuracy of climate model simulations.

In addition, the ARM Program is actively developing a new ARM Mobile Facility (AMF) that will be available for short deployments (several months to a year or more) in climatically important regions. The AMF will have much of the same instrumentation as the remote facilities at ARM's Tropical Western Pacific and the North Slope of Alaska sites. Over time, this new facility will extend ARM science to a much broader range of conditions for model testing.