Office of Science
Financial Assistance
Funding Opportunity Announcement
DE-PS02-07ER07-24

Atmospheric Radiation Measurement (ARM) Program Announcement

The Office of Biological and Environmental Research (BER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving applications to develop innovative techniques for observational data analysis and improved/new climate modeling parameterizations that represent clouds and their impact on the atmospheric radiation balance in conjunction with the Atmospheric Radiation Measurement (ARM) Program in the Climate Change Research Division (CCRD) as part of the U.S. Climate Change Science Program (CCSP).

PREAPPLICATIONS

Potential applicants are required to submit a preapplication, referencing **Program Notice DE-PS02-07ER07-24 for receipt by DOE by 4:30 p.m., Eastern Time, March 22, 2007.** Preapplications, referencing Program Solicitation DE-PS02-07ER07-24, should be sent to Dr. Kiran Alapaty by e-mail: kiran.alapaty@science.doe.gov. Please include "Preapplication - DE-PS02-07ER07-24" in the subject line of the e-mail.

All preapplications will be reviewed relative to the scope and research needs of the ARM Program. A response to each preapplication, discussing the potential program relevance of research for a formal application, generally will be communicated within 15 days of receipt. Applicants who have not received a response regarding the status of their preapplication within a reasonable time are responsible for contacting the program to confirm the status.

A preapplication should consist of two or three pages of narrative describing the research objectives, methods of accomplishment, and references. Principal Investigator (PI) address, telephone number, fax number, e-mail address, Program Notice Number, estimate of level of funding requested, and names of all senior personnel are required additional parts of the preapplication.

SC's preapplication policy can be found on SC's Grants and Contracts Web Site at: http://www.science.doe.gov/grants/preapp.html. Please contact Dr. Kiran Alapaty for any questions related to this announcement. Applicants should allow sufficient time so that the formal application deadline is met.

APPLICATION DUE DATE: May 7, 2007, 8:00 pm, Eastern Time

Applications must be submitted using Grants.gov, the Funding Opportunity Announcement can be found using the CFDA Number, 81.049 or the Funding Opportunity Announcement Number,
DE-PS02-07ER07-24. Applicants must follow the instructions and use the forms provided on Grants.gov.

FOR FURTHER INFORMATION CONTACT:

For further information regarding this notice,

Contact: Dr. Kiran Alapaty
Telephone: (301) 903-3175
E-mail: Kiran.Alapaty@science.doe.gov

SUPPLEMENTARY INFORMATION:

Background:

The Climate Change Research Division (CCRD) has established the following Long Term Measure (LTM): Deliver improved scientific data and models about the potential response of the Earth's climate and terrestrial biosphere to increased greenhouse gas levels for policy makers to determine safe levels of greenhouse gases in the atmosphere. The ARM goal to improve the treatment of radiation and clouds in the General Circulation Models (GCMs) used to predict future climate directly addresses the LTM. ARM also addresses the U.S. Climate Change Science Program (CCSP) goal to improve the capability to accurately simulate and predict climate and climate change. Thus, the major component of ARM involves gathering and analyzing data for the development and testing of models of the atmospheric radiation transfer, properties of clouds, and the full life cycle of clouds with the ultimate goal of developing and validating new parameterizations for climate models.

The ARM program has been promoting the development of climate data sets from ARM measurements for several atmospheric variables. The ARM Climate Research Facility has established and operates three fixed facilities (the Southern Great Plains (SGP), the Tropical Western Pacific (TWP), and the North Slope of Alaska (NSA)), to collect radiation and cloud data on the climatic regimes represented by each of the three respective site locations. In addition, the ARM program has also developed the ARM Mobile Facility (AMF) to collect cloud and radiation data in several climatic regimes. The ARM Aerial Vehicle Program (AVP) provides aerial measurement platforms that can be used to support experiments at the fixed sites or in conjunction with the mobile facility. The SGP (http://www.arm.gov/sites/sgp.stm) was chosen as a field measurement site for several reasons including its relatively homogenous geography, wide variability of climate, cloud type, and surface flux properties, and large seasonal variation in temperature and specific humidity. The second facility, TWP (http://www.arm.gov/sites/twp.stm), consists of stations at Darwin, Australia, and on the islands of Manus, Papua, New Guinea and the Republic of Nauru respectively. This region was selected because it plays a large role in the interannual variability observed in the global climate system. The third facility, the NSA (http://www.arm.gov/sites/nsa.stm), is located at Barrow, Alaska,

with a secondary inland site near Atqasuk. The NSA location was selected because it provides data about cloud and radiative processes at high latitudes, and by extension, about cold and dry regions of the atmosphere in general. The AMF (http://www.arm.gov/sites/amf.stm) was developed to collect climate data to address science questions beyond those addressed by the measurements at fixed sites. The AMF is similar to the fixed site facilities in that it contains many of the same instruments and data systems, but is designed to be deployed around the world for campaigns lasting 6-12 months. The first AMF deployments have been located in Pt. Reyes, California, and Niamey in Niger (13.5ºN 2ºE).

The ARM Climate Research Facility regularly supports field campaigns to augment routine data acquisitions. Any field campaign which is proposed, planned, and implemented using any of the facilities (SGP, NSA, TWP, AMF, and AVP) is referred to as an intensive operational period (IOP). Recent IOPs include the Mixed-Phase Arctic Cloud Experiment (http://www.db.arm.gov/cgi-bin/IOP2/selectExecSummary.pl?iopName=nsa2004arcticcld&person_id= and the TWP Tropical Warm Pool - International Cloud Experiment (TWP-ICE) (http://www.db.arm.gov/cgi-bin/IOP2/selectExecSummary.pl?iopName=twp2006twp-ice&person_id=).

The data related to radiation and clouds collected from these facilities comprise a climatic observational database. The goal of the ARM program is to use this unique observational database to understand radiation and cloud processes at various climatic regimes and to improve the representation of clouds and radiation processes in GCMs. The representation of clouds and their sensitivities is largely responsible for the high degree of uncertainty associated with the magnitude of climate change induced by human modification of carbon dioxide, other trace gases, and aerosols.

Program information is available on http://www.science.doe.gov/ober/CCRD/arm.html. Background material on ARM science is available through the ARM Science Plan http://www.arm.gov/publications/programdocs/doe-er-arm-0402.pdf

Request for Grant Applications:

All applications submitted in response to this Notice must explicitly state how the proposed research will support accomplishment of the BER CCRD's Long Term Measure of Scientific Advancement: "Deliver improved scientific data and models about the potential response of the Earth's climate and terrestrial biosphere to increased greenhouse gas levels for policy makers to determine safe levels of greenhouse gases in the atmosphere."

This Notice requests applications for grants, both new and renewal that address the ARM goal of improving the accuracy of climate model simulations by enhancing the representation of cloud and radiation processes in climate models. The research areas of interest include the development of algorithms for retrieving the required measurements from ARM instruments, studies utilizing ARM data to improve the understanding of cloud and radiation physical processes, the translation of process study results into process models and parameterizations, and the incorporation of the submodels into climate models. Research to develop tools and methodologies for making ARM data more useful for the development and testing of climate

models is especially encouraged. Modeling areas of interest include convection triggering conditions, closure assumptions, mechanisms and magnitudes of convective and mesoscale updrafts and downdrafts, convection-PBL interactions, and interactions of 3-D cloud and radiative processes.

Specific areas of interest to the ARM program follow:

- Developing and testing methodologies to use ARM observations in atmospheric models, both at the cloud resolving model scale and the global climate model scale.
- Incorporating new findings from the ARM data analysis into the cloud resolving or in the 1-D and 3-D versions of GCMs. Applicants are encouraged to review the research status of the ARM data analysis and products available at URL http://www.arm.gov/data/ and http://stm.arm.gov/pastmeetings.stm
- Improving existing or developing new radiation and cloud parameterizations for global models using ARM observations.
- Developing new techniques to retrieve and analyze the properties of different types of clouds, with a special focus on the properties of deep convective clouds and ice and mixed-phase clouds.
- Analyzing data obtained from MPACE, TWP-ICE, CLASIC, and COPS field campaigns, and evaluating model simulations against observed clouds and their properties.
- Conducting analyses to improve our understanding of cloud and radiation processes including the 3-D cloud-radiation process at scales from the local atmospheric column to the GCM grid square and the relationship between atmospheric radiation and the life-cycle of tropical and high latitude clouds.
- Quantifying the effects of aerosols on cloud properties and the resulting radiation field, using a combination of ARM observations and physical models.

Applications are limited to those that utilize ARM generated data in the proposed research. Applications for instrument development will not be considered. Applications that require a special field campaign, which has not already been planned and approved by the ARM Climate Research Facility Program Manager, will not be accepted for consideration. For approved campaigns see (http://www.db.arm.gov/cgi-bin/IOP/iops.pl.)

Applications for research to develop new techniques to retrieve the properties of clouds using ARM data should be targeted on the development of methods for deriving long-term records of cloud microphysical and macrophysical properties at multiple locations. Also, these retrieval techniques must include quantitative uncertainty analysis for cloud properties estimates. New or improved methods for radiative transfer in cloudy atmospheres, including the overlap problem of stratiform cloud layers are especially encouraged. The proposed studies may include, but are not limited to, 3-D radiative transfer, representations of cloud overlap, mixed phase clouds, cloud life cycles, feedback processes (especially in the Arctic and tropical regions), and other processes important for clouds such as convection and turbulence and their effects on radiative transfer. The emphasis on the Arctic feedback is based on the need to test the hypothesis that links large climate feedbacks with surface and tropospheric temperatures, surface albedo, cloud cover, deep ocean water production (the global thermohaline ocean circulation pump), and the polar atmospheric heat sink.

Applications for research to develop and test new cloud and radiation process models should highlight scientific advancement over existing methods and focus on investigating the validity of assumptions that are associated with such models and how well the ensemble of cloud and radiation sub models simulate clouds and their effect on radiation fields in the climate models. Areas of interest include treatment of turbulent mixing in shallow and deep convection, convection triggering conditions, closure assumptions, mechanisms and magnitudes of convective and mesoscale updrafts and downdrafts, convection-PBL interactions, and the importance of 3-D radiative transfer. Applicants are strongly encouraged to utilize the tools that have been developed for this purpose in the Climate Change Prediction Program - ARM Parameterization Testbed (CAPT) (http://www-pcmdi.llnl.gov/projects/capt/) effort at DOE's Program for Climate Model Diagnosis and Intercomparison (PCMDI).

Applications on research to develop and apply methodologies to use ARM data more effectively in atmospheric models should focus on either providing data to initialize and constrain limited area models, both single column models and cloud resolving models, or on providing data to evaluate model performance. Research on forcing data sets should develop data to provide the required boundary conditions at model top and sides to run simulations for the NSA and TWP locations. Research to provide data to evaluate model performance should address either converting ARM measurements into the forms that can be directly compared with climate model output or developing techniques for converting climate model output to a form that is equivalent to ARM measurements.

Applications for research to quantify the effect of aerosols on the radiation field should focus on both the indirect and direct role of aerosols on radiative transfer and cloud properties. Specifically, the research should relate observations of radiative fluxes and radiances to the atmospheric composition, especially the optical properties of aerosols, and use these relations to develop and test parameterizations and/or process models to accurately predict the effect of aerosols on the atmospheric radiative properties. Note that the DOE Atmospheric Science Program (ASP) was reconfigured in FY 2004 to focus on aerosol radiative forcing with new research that began in early FY 2007 and supports aerosol research on aerosol processes and resulting properties that influence radiation fields. Applications spanning the objectives of ARM and ASP programs will be jointly reviewed by these two programs. More details on the ASP program can be found at http://www.asp.bnl.gov/.

To ensure that the program meets the broadest needs of the research community and the specific needs of the DOE CCRD, successful applicants are expected to participate as ARM Science Team members in the appropriate working group(s) relevant to their efforts. Costs for participation in ARM Science Team meetings and working group meetings should be based on two trips of 1 week each to Washington, DC, and two trips of 3 days each to Chicago, Illinois.

Program Funding

It is anticipated that approximately $3,000,000 to $4,000,000 will be available for about 20 to 25 awards ranging from $50,000 to 150,000/year in Fiscal Year 2008, contingent upon the availability of appropriated funds. Multiple-year funding of awards is expected, with out-year funding also contingent upon the availability of appropriated funds, progress of the research, and

programmatic needs. The allocation of funds within the research areas will depend upon the number and quality of applications received. Awards are expected to begin early Fiscal Year 2008. Equal consideration will be given to renewal and new applications. Funds for this research will come from the ARM Program. DOE is under no obligation to pay for any costs associated with preparation or submission of applications.

Posted on the Office of Science Grants and Contracts Web Site
February 22, 2007.