Office of Science
Financial Assistance
Funding Opportunity Announcement
DE-PS02-07ER07-26

Atmospheric Science Program

The Office of Biological and Environmental Research of the Office of Science (SC), U.S. Department of Energy, hereby announces its interest in receiving applications for research grants in experimental and theoretical studies of aerosol radiative forcing of climate in conjunction with the Atmospheric Science Program in the Climate Change Research Division as part of the U.S. Climate Change Science Program.

PREAPPLICATIONS

Potential applicants are **required** to submit a preapplication, referencing **Program Notice DE-PS02-07ER07-26 for receipt by DOE by 4:30 p.m., Eastern Time, May 1, 2007.** Preapplications should be sent to Dr. Ashley D. Williamson, ASP Program Manager, via E-mail to: ashley.williamson@science.doe.gov . Please include "Preapplication - ASP Program Notice" in the E-mail subject field.

All preapplications will be reviewed relative to the scope and research needs of the ASP 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 this status. Applicants should allow sufficient time so that the formal application deadline of June 18, 2007 is met.

A preapplication should consist of two or three pages of narrative describing the research objectives, methods of accomplishment, estimate of level of funding to be requested, and references. The preapplication should identify, on the cover sheet, the title of the project, the institution or organization, principal investigator name, telephone number, fax number, and e-mail address, and the names and affiliations of any proposed team members.

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. Ashley D. Williamson for any questions related to this announcement. Applicants should allow sufficient time so that the formal application deadline is met.

APPLICATION DUE DATE: June 18, 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-PS02-07ER07-26. 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. Ashley D. Williamson, ASP Program Manager
Telephone: 301-903-3120
Fax: 301-903-8519
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SUPPLEMENTARY INFORMATION:

Background:

Understanding the role of aerosols in climate forcing is a critical factor in climate change research, as well as an essential element in advancing the state of the art in climate modeling. Aerosol forcing appears to be the same order of magnitude as the forcing from greenhouse gases, but far more uncertain. Aerosol forcing has two major components, direct and indirect. Direct effects of aerosols are the influence of the aerosols on the Earth's radiation balance due to the scattering and absorption of radiation by particles in clear (cloud-free) air. Indirect effects of aerosols include their influence on the radiation balance and hydrology through their impact on cloud microphysical properties (first indirect effect) and amount (second indirect effect). There is also a semi-direct effect, in which the heating by aerosol particles due to absorption of solar radiation decreases cloud amount.

In response to the needs of the Climate Change Science Program (CCSP), the Office of Biological and Environmental Research (BER) of the Department of Energy (DOE) reconfigured its Atmospheric Science Program (ASP) to focus on the role of atmospheric aerosols in radiative forcing of the Earth's climate. The reconfiguration plan was developed in response to a panel of experts convened by the Biological and Environmental Research Advisory Committee (BERAC). The BERAC committee report recommended a "*well-balanced program consisting of field measurements, laboratory experiments, theoretical analysis with process modeling, and development and application of new instrumentation*". (The full BERAC committee report may be found at http://www.science.doe.gov/ober/berac/ASP.pdf). This plan was executed during 2004, (see ASP Program Description at http://www.asp.bnl.gov/files/010-ASP-040503-PD.pdf) and the first cycle of research projects under the new configuration were awarded for performance during FY 2005-2007. New and renewal grants awarded in response to this notice will continue the current program focus into the FY 2008-2010 period. The two ASP Program documents referenced above describe program priorities applicable to both periods, and applicants are encouraged to refer to both when preparing their applications. Other information on program activities under the current ASP configuration may be found on the ASP website http://www.asp.bnl.gov/.

Request for Grant Applications

This notice requests applications for new and renewal grants that address the ASP objective of providing and improving the scientific knowledge needed to simulate and predict radiative forcing by aerosols and the resulting effects on climate.

All applications submitted in response to this Solicitation must explicitly state how the proposed research will support accomplishment of the BER Climate Change Research Division's (CCRD) Long Term Measure of Scientific Advancement which is to 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.

Applicants seeking renewal of present grants should demonstrate, in their application, (a) the continued relevance of their work to the goal of advancing the science of radiative climate forcing by aerosols, (b) the quality and relevance of work conducted under previous support to these goals, including a listing of publications and presentations; and (c) relevant contributions to the development of DOE climate forcing and modeling programs, including participation in the organization of meetings and workshops and collaborations with other CCRD-supported investigators. The technical portion (Project Narrative) of the application should include a section titled "Accomplishments under Previous Support" that addresses items (b) and (c) above. This section is exempt from the overall page limit for the Project Narrative, but should not exceed 5 pages. Applicants should be prepared to provide, on short notice, complete legible copies of all publications, reports, etc., listed in this section, should they be required for the review process.

Applications focused on the following research topics are encouraged:

As described above, applications for ASP projects are solicited in the following functional categories: (1) focused laboratory studies, (2), field studies, (3) fundamental theoretical and process modeling, and (4) the development of new aerosol measurement instruments and methods. These categories are not mutually exclusive; in fact, projects in one category should generally have applicability to program activities in the other categories.

LABORATORY STUDIES

Laboratory studies are required to provide a basis of understanding of the processes governing aerosol formation and transformation in the atmosphere, especially processes that affect the optical and cloud nucleating properties of aerosols. This understanding is required to represent these processes in atmospheric models. ASP will support laboratory studies directed to these issues. It is important that ASP laboratory experiments be closely coupled to field measurements and theoretical/modeling studies to investigate the physical and chemical evolution of particles and how this evolution alters their radiative and cloud-nucleating properties. This will allow interpretation of the field data and appropriate translation into models that will accurately reflect the processing of particles in the atmosphere and provide the needed capabilities to simulate and predict the extent to which these changes affect the direct and indirect radiative forcing by aerosols.

Applications are encouraged for laboratory studies that address the scientific areas and ASP program priorities described above. Applications for laboratory studies must demonstrate relevance to what actually goes on in the atmosphere, and the importance of the atmospheric processes studied to aerosol radiative forcing. Applications should also address how the anticipated findings concerning these processes can be verified via field studies, and how they may be incorporated into atmospheric models of relevance to climate research needs. Applicants should note that these factors will be evaluated in determining the programmatic relevance of the proposed research.

Subject to the above considerations, a broad range of atmospheric aerosol processes are of program interest, and applicants should consult the ASP program documents referenced above. Listed below are some examples, taken from these documents, of types of laboratory studies anticipated to be useful in coupling the results of field studies to models and in providing and improving understanding of key processes that are or need to be represented in models. Several projects in these categories were selected in the current ASP cycle.

- Measurement of kinetics, mechanisms, and products of the oxidation of organic aerosol constituents and their precursors by tropospheric oxidants (e.g., OH, O3, NO3) for different forms of organics in the absence and presence of inorganics (e.g., aqueous NO3 and SO4). Included in this area would be identification of interactions between natural and anthropogenic aerosols and precursors (e.g., acid-catalyzed reactions of organics in particles) and elucidation of the role of trace gases such as NOx in the formation and further oxidation of organic aerosols. These studies should address the large uncertainties in the role of secondary organic aerosols and carbonaceous aerosols as Cloud condensation nuclei (CCN) due to changes in their physical properties from atmospheric processing. These changes may also have an effect on their life cycle in the atmosphere.
- Research to improve understanding of interactions of organic and organic-coated aerosols with water vapor and liquid water, as well as the uptake and reactions of trace gases such as HNO3, SO2, etc., that are known to modify the optical properties of an aerosol particles as well as their ability to function as CCN.
- Research to understand the potential of organics and mixed particles to serve as CCN and ice-forming nuclei (IN), including the effects of changes in their properties induced by chemical processing or "aging" of the particle.
- Determination of optical properties of particles of mixed composition and phase including both inorganics as well as organics (e.g., non-spherical particles of sulfate and water layers on soot, liquid layers surrounding solid cores, surfactant layers on aqueous and solid substrates).
- Research to understand nucleation mechanisms and how to represent them in models, including mechanisms of new particle formation and nucleation involving trace gases such as ammonia (NH3) and volatile organic compounds.
- Identification of "markers" for natural vs. anthropogenic components of ambient aerosols.
- Research to better understand the chemical characteristics of particles designated as "black carbon" by current methods. This is important because "black carbon" is chemically complex and is defined in a number of ways.

FIELD STUDIES

Field studies are an essential component of any comprehensive aerosol research program. Real world measurements are the only means to identify and quantify processes that occur in the actual atmosphere, evaluate performance of models, and evaluate remotely-sensed data retrievals. ASP field studies are typically large-scale intensive campaigns involving multiple investigators within the program and frequently investigators from other DOE programs or other organizations. It is anticipated that many of the ASP field studies will be done in collaboration with aerosol research programs in other agencies. Typical scope and methodology involved in ASP field studies are described in further detail in the BERAC reconfiguration report and the ASP Program Description referenced above. Specific details of recent field campaigns and those planned for the near future can be found on the ASP website http://www.asp.bnl.gov/.

Applications are encouraged that involve participation in the design, conduct, and/or interpretation of one or more of the program-sponsored field studies described below. Applications are especially encouraged that couple field measurements with laboratory studies or model validation activities of the applicants to provide added value insight into specific relevant aerosol forcing issues or processes. Applications should describe in detail the proposed field campaign participation, the specific proposed measurements and analyses to be performed, and how the proposed additional field activity will address ASP goals. Applications should also identify any proposed collaborations with other current or proposed projects.

During the coming program cycle available resources will allow two or three field campaigns. The first, tentatively planned for October 2008, is a cloud microphysics/indirect effect study in the marine stratus cloud field off the coast of Chile. The ASP activities are planned as part of the multi agency VAMOS Ocean-Cloud-Atmospheric-Land Study (VOCALS) to be conducted under the auspices of the National Science Foundation (NSF). Further information on this campaign is contained in a white paper "ASP participation in the fall 2008 VOCALS study" available at http://www.asp.bnl.gov/ASP_VOCALS_Plan.pdf. Another indirect effects study scheduled during 2008 is the Indirect and Semi-Direct Aerosol Campaign (ISDAC), scheduled at the Atmospheric Radiation Measurement (ARM) North Slope of Alaska (NSA) locale in April 2008. While ASP is not a formal collaborator in this ARM-sponsored study, ASP investigators are invited to propose participation in this campaign if otherwise appropriate to the scope of their projects. Further information is available at http://www.asp.bnl.gov/ARM_ISDAC.pdf.

The remaining ASP field campaigns for FY 2008-2010 have not been selected, but may be assumed to involve "clear air" aerosol life cycle studies within the continental United States. It is furthermore likely that these field campaigns will include investigations of secondary organic aerosols from both anthropogenic and biogenic precursors.

It is anticipated that conducting field studies will be a principal focus for the DOE laboratories, with participation by other science team members wherever appropriate. Applicants should assume that DOE laboratory personnel will provide overall campaign management and logistical coordination, as well as the primary measurement suite as follows. For major ASP field campaigns, the program will provide separate support for an aircraft platform and ground-based and air-borne instrumentation, e.g., measurements of relevant trace gas concentrations, particle size distributions, vertical and horizontal wind components, meteorological state parameters, and

standard radiation measurements. Additionally, depending on the campaign, the aircraft may also be able to accommodate selected PI-based instruments.

Description of available program resources typically provided for field campaigns can be found on the ASP website at http://www.asp.bnl.gov//#Science_Support. Applications should identify the measurements normally provided by the program that are essential to the success of their proposed field study. Required field measurements not provided separately by the program should also be identified and included in the proposed budget of the application. Applicants should describe their intended measurements in the required preapplications so that logistical requirements may be assessed in advance. Such advance coordination is especially necessary if applicants are proposing modifications to the payload of the G-1 Aircraft platform or additions to ASP - provided ground measurement stations. Applicants should also note that all field campaign participants are required to adhere to the ASP data policy, which is available at http://www.asp.bnl.gov/datapolicyR3.html.

Funding for a project that requires a special field campaign, which has not already been planned and approved by the ASP Program Manager, will be contingent on recommendation of the campaign by the ASP Science Steering Committee and final approval by the DOE Program Manager.

THEORETICAL/PROCESS MODELING

The climate modeling community needs improved process models of aerosols, for both direct and indirect effects, to better account for the effects of aerosols on regional and global climate. DOE, within the Climate Change Prediction Program (CCPP), is a major developer and user of advanced global climate models that incorporate representations of major processes in all climate global regimes, including atmospheric processes. Still, even at the current state of the art, climate model representations of atmospheric aerosol and cloud processes are highly simplified, and arguably not representative. This dilemma is twofold: Due to limitations in computational technology, global climate models cannot afford the complexity of process model representations available even in the current generation of atmospheric chemical transport models. Second, for several important atmospheric processes the available experimental information is itself inadequate to incorporate into models or to validate their predictions.

The need for accurate and computationally efficient representations of atmospheric processes for models exists on scales from local to global. These models need to represent the chemistry and microphysics that govern the formation, radiative properties, cloud-nucleating properties, and fate of carbonaceous, inorganic, and mixed carbonaceous/inorganic aerosols. It is especially important that knowledge about the mechanisms controlling the lifetime and removal rates of aerosols be represented in models so as to better simulate quantitatively the concentration and distribution and radiative and cloud-modifying properties of atmospheric aerosols.

ASP does not have the mission to develop or modify global climate models or even new regional atmospheric models; rather, the theoretical focus of ASP is to represent process information derived from laboratory and field studies in forms adaptable to atmospheric chemical transport models and ultimately to global models. In this sense the climate modeling community, as

represented within DOE by the CCPP, is a major client for the research to be conducted in ASP. Related activities include comparison of laboratory and field process results with predictions of these process model algorithms at the appropriate scales.

Accordingly, applications are encouraged for studies that improve the theoretical representation of aerosol processes studied in ASP laboratory or field studies; for projects that enhance incorporation of aerosol process information into modules suitable for large-scale or global atmospheric models; and for projects that provide systematic experimental validation of process model predictions at appropriate scales using data from targeted laboratory and field experiments. This request for applications also explicitly includes theoretical and process model analyses of data from past ASP laboratory or field studies.

It is expected that all of these modeling efforts will be coordinated with the CCPP. It is essential that ASP research be tailored to the needs of the climate modeling community and that the program provide specific, measurable, and meaningful deliverables that are of use to the climate modeling community. Applications should thus address plans for incorporating anticipated modeling improvements into general circulation models (GCMs). Modeling studies must also have explicit ties to design and interpretation of ASP field studies, rather than be stand-alone projects. Emphasis will be on improving models that also include chemistry and more realistic treatment of cloud microphysics. Information about CCPP can be found at http://www.science.doe.gov/ober/CCRD/model.html.

INSTRUMENT AND METHODS DEVELOPMENT

Better understanding of the indirect effect of aerosols on clouds and of the direct effects of aerosols on the climate requires several instrument developments or refinements. The need for Instrument Development projects and several specific development priorities are described in detail in the BERAC reconfiguration report and the ASP Program Description referenced above. These priorities still exist; however, currently available program funds limit the number of awards available in this area. In the current ASP funding cycle some instrument development projects were initiated both at DOE laboratories and at institutions eligible for this solicitation.

Renewal applications for existing projects will be considered under this topic area, as will new project applications. However, since only the most promising new instrument ideas can be funded under the constraints of projected ASP funds, applicants for Instrument Development projects are advised to submit the required preapplication as early as feasible before the preapplication deadline. DOE can then provide earlier feedback on program relevance, allowing the applicant to assess the likelihood of success before submitting a full application. Additional opportunities for additional funding are available through DOE's SBIR/STTR Program, (http://sbir.er.doe.gov/sbir/) and eligible entities should also consider applying to that program.

Other considerations

Note that another DOE program, the ARM Program, also supports research on quantifying the effect of aerosols on the radiation field, by investigating both the direct role of aerosols on radiative transfer and the indirect role on cloud properties. Specifically ARM research relates

observations of radiative fluxes and radiances to the atmospheric composition and uses these relations to develop and test parameterizations to accurately predict the atmospheric radiative properties. In contrast, the ASP will support aerosol research with emphasis on aerosol processes and resulting properties that would influence the radiation fields. The ARM science program has issued a solicitation
(DE-PS02-07ER07-24) for grant applications for the FY 2008-2010 period. Applications spanning the objectives of ARM and ASP programs will be jointly reviewed by these two programs, and may be funded by either program or jointly by both. Therefore duplicate applications should not be submitted in response to both solicitations; such applications should be submitted once, to the program that the applicant judges to be most relevant to the proposed research. Information about ARM can be found at http://www.arm.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 ASP Science Team members in the appropriate working group(s) relevant to their efforts. Costs for participation in ASP Science Team meetings and working group meetings should be included in the budget and be based on two trips of 4 days each to Washington, DC, and two trips of 3 days each to Chicago, Illinois, for each year of the project.

Program Funding

It is anticipated that up to **$4,000,000** will be available for about **20** awards ranging from **$75,000 to $250,000**/year in Fiscal Year 2008, contingent upon the availability of appropriated funds. Applications may request project support up to three years, with out-year support contingent on the availability of 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 in FY 2008. Equal consideration will be given to renewal and new applications. DOE is under no obligation to pay for any costs associated with preparation or submission of applications. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this Notice.

Posted on the Office of Science Grants and Contracts Web Site
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