

Office of Science
Notice 01-09

*Scientific Discovery through Advanced Computing: Climate
Change Prediction Program*

Department of Energy
Office of Science

**Office of Science Financial Assistance Program Notice 01-09; Scientific
Discovery through Advanced Computing: Climate Change Prediction Program**

AGENCY: U.S. Department of Energy

ACTION: Notice inviting grant and cooperative agreement applications.

SUMMARY: The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving applications to support the development of simulation models for decadal to multi-century climate prediction in conjunction with the Climate Change Prediction Program (CCPP), a part of the U.S. Global Change Research Program.

DATES: Applicants are encouraged (but not required) to submit a brief preapplication for programmatic review. There is no deadline for the preapplication, but early submission of preapplications is encouraged to allow time for meaningful discussions.

Formal applications submitted in response to this notice must be received by 4:30 p.m., E.S.T., March 15, 2001, to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2001.

ADDRESSES: Preapplications referencing Program Notice 01-09 may be sent to the program contact, Dr. David C. Bader, via electronic mail at dave.bader@science.doe.gov or by U. S. Postal Service Mail at the following address: Office of Biological and Environmental Research, Environmental Sciences Division, SC-74, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290.

Formal applications referencing Program Notice 01-09 should be forwarded to: U.S. Department of Energy, Office of Science, Grants and Contract Division, SC-64, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Notice

01-09. This address also must be used when submitting applications by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand-carried by the applicant. An original and seven copies of the application must be submitted; however, applicants are requested not to submit multiple application copies using more than one delivery or mail service.

FOR FURTHER INFORMATION CONTACT: Dr. David C. Bader, Office of Biological and Environmental Research, Environmental Sciences Division, SC-74, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, telephone (301) 903-5329, fax (301) 903-8519, Internet e-mail address: dave.bader@science.doe.gov. Program information is available on the DOE/OBER WWW site using the URL: <http://www.sc.doe.gov/production/OBER/GC/model.html>.

SUPPLEMENTARY INFORMATION:

Background: Scientific Discovery through Advanced Computing and the Climate Change Prediction Program

Accurate prediction of climate change on decadal and longer time scales remains a major scientific objective of the Environmental Sciences Division (ESD). The Climate Change Prediction Program (CCPP) is the current phase in the evolution of DOE's long-standing climate modeling and simulation research agenda. The program is focused on developing, testing and applying climate simulation and prediction models that stay at the leading edge of scientific knowledge and computational technology. The program will continue the development of models based on more definitive theoretical foundations and improved computational methods that will run efficiently on current and future generations of high-performance scientific supercomputers. The intent is to increase dramatically both the accuracy and throughput of computer model-based predictions of future climate system response to the increased atmospheric concentrations of greenhouse gases. Concurrently, to meet the challenge posed by the new generation of terascale computers with peak speeds of 10 to 100 trillion Operations Per Second (teraOPS), SC will fund a set of coordinated investments in scientific computing, through its Scientific Discovery through Advanced Computing (SciDAC) Program. It will create a scientific computing software infrastructure that bridges the gap between the advanced computing technologies being developed by the computer industry and the scientific research programs sponsored by the Office of Science. The CCPP portion of SciDAC, has been labeled the Accelerated Climate Prediction Initiative.

To ensure that the program meets the broadest needs of the research community and the specific needs of ESD, the successful applicants will participate as members of the Climate Change Prediction Program Science Team along with selected scientists from

related ESD and SC programs. Costs for the participation in Science Team meetings and workshops should be included in the respondent's application. Yearly estimates for Science Team travel should be based on one trip of five days to Washington, DC, one trip of five days to San Francisco, CA, and one trip of five days to Denver, CO.

Request for Cooperative Agreement Applications

This notice requests *applications for cooperative agreements* in the following area:

The development of prototype climate models of the future including new formulations, numerical methods, algorithms and computational techniques, that will underpin the construction of production-quality climate GCMs in the five to ten year time frame.

Successful applicants for cooperative agreements to develop models of the future will devise a multi-disciplinary research strategy that addresses both climate science and computational science challenges facing the development of production-quality climate GCMs in the five to ten year time frame. These challenges include, but are not limited to, model formulations that accurately simulate critical climate processes and efficient algorithms that will execute on future high-end computer architectures such as multi-threaded and processor-in-memory designs that are anticipated to have theoretical peak speeds over 100 TeraOPS. Successful applications will convey a strong emphasis on multi-disciplinary graduate training. Cooperative agreements differ from grants in that there is continuing substantial involvement by DOE in the conduct of the research.

Request for Grant Applications

Additionally, this notice requests *applications for grants* in the following four areas:

- (1) Theoretical limits to global climate prediction over decade to multi-century time frames with subcontinental and smaller scale spatial accuracy.
- (2) The development of improved representations of key climate processes (surface processes, convective transport, etc.) that accurately simulate these processes on the appropriate scales used in general circulation model (GCM) based climate models that simulate decade-to-century climate change.
- (3) The development of improved mathematical techniques, model formulations and computer algorithms for atmosphere, ocean and coupled atmosphere-ocean GCMs that more accurately and efficiently describe and

predict global climate system behavior on the time and space scales mentioned above using advanced, parallel-processing scientific supercomputers.

(4) The development of diagnostic methods and tools to evaluate the ability of GCM-based climate models to accurately describe and predict global climate system behavior on the time and space scales mentioned above.

Successful applicants for grants exploring the theoretical limits of climate prediction will conduct studies of the climate system to ascertain the capability for climate simulation models to predict the aspects of the climate system that influence near-surface temperature, precipitation and winds, decades to centuries in the future. These studies may include, but are not limited to, analytical and modeling investigations of the coupled climate system, or components of the climate system, to identify climate dynamical mechanisms that influence long-term variability and predictability over continental and subcontinental spatial scales.

Successful applicants for grants to develop or improve representations of climate system processes for inclusion in GCM-based climate prediction models will conduct research to more accurately describe these processes and their interaction with other aspects of the simulated climate system. These studies will explore methods for incorporating the results of the U.S. Global Change Research Program's observational and experimental programs into model components that accurately describe climate system processes at the model resolution scales typically used for decade-to-multi-century climate prediction. Applicants in this area must include a plan for the dissemination of any developed model code, and necessary documentation, to the climate modeling community.

Successful applicants for grants to develop new mathematical techniques and numerical algorithms will target their research toward methods that can be incorporated into models running on highly parallel scientific supercomputers capable of performing over 10 trillion operations per second (10 teraOPS). Applicants must demonstrate the role of their research in improving the accuracy and/or computational efficiency of GCM-based climate simulation models of the type envisioned for use in making forecasts of long-term climate change. These methods may be used in the simulation of any or all of the climate system processes modeled in a GCM, including, but not limited to, atmospheric and ocean dynamics and transport, surface energy and mass exchange, atmospheric radiative transfer, ocean convection, and sea-ice dynamics and thermodynamics. Applicants in this area must include a plan for the dissemination of any developed model code, and necessary documentation, to the climate modeling community.

Successful applicants for grants to develop diagnostic methods and tools will focus their research on new or greatly improved diagnostic methodologies to objectively evaluate the ability of GCM-based climate models to accurately simulate climate dynamics and global climate on the time and space scales described above. Particularly important are observation-based diagnostic methods that can be applied consistently to multiple models to identify sources of predictive uncertainty. Applicants in this area must be willing to cooperate with other groups in building the new methodologies into comprehensive diagnostic packages that will be freely available to the broader climate modeling community.

Program Funding

It is anticipated that approximately \$5,000,000 will be available for awards in Fiscal Year 2001, 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. SC anticipates that *grant* awards in this area will be approximately \$200,000 per year, but may range from \$50,000 to \$600,000. SC anticipates that *cooperative agreement* awards will be approximately \$1,000,000 per year.

Collaboration

Applicants are strongly encouraged to collaborate with researchers in other institutions, such as: universities, industry, non-profit organizations, federal laboratories and Federally Funded Research and Development Centers (FFRDCs), including the DOE National Laboratories, where appropriate, and to include cost sharing wherever feasible. Additional information on collaboration is available in the Application Guide for the Office of Science Financial Assistance Program that is available via the Internet at: <http://www.sc.doe.gov/production/grants/Colab.html>.

Preapplications

Potential applicants are strongly encouraged to submit a brief preapplication that consists of two to three pages of narrative describing the research project objectives and methods of accomplishment. These will be reviewed relative to the scope and research needs of the SC's Climate Change Prediction Program. Principal investigator address, telephone number, fax number and e-mail address are required parts of the preapplication. A response to each preapplication discussing the potential program relevance of a formal application generally will be communicated within 30 days of receipt. There is no deadline for the submission of preapplications, but applicants

should allow sufficient time in order for formal application deadlines to be met. SC's preapplication policy can be found on SC's Grants and Contracts Web Site at: <http://www.sc.doe.gov/production/grants/preapp.html>.

Merit Review

Applications will be subjected to formal merit review (peer review) and will be evaluated against the following evaluation criteria which are listed in descending order of importance codified at 10 CFR 605.10(d):

1. Scientific and/or Technical Merit of the Project;
2. Appropriateness of the Proposed Method or Approach;
3. Competency of Applicant's personnel and Adequacy of Proposed Resources;
4. Reasonableness and Appropriateness of the Proposed Budget.

The evaluation will include program policy factors, such as the relevance of the proposed research to the terms of the announcement and an agency's programmatic needs. Note, external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers will often be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

Submission Information

Information about development and submission of applications, eligibility, limitations, evaluation, selection process, and other policies and procedures may be found in 10 CFR Part 605 and in the Application Guide for the Office of Science Financial Assistance Program. Electronic access to the Guide and required forms is made available via the World Wide Web at: <http://www.sc.doe.gov/production/grants/grants.html>. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications if an award is not made. The technical portion of the application should not exceed twenty-five (25) double-spaced pages and should include detailed budgets for each year of support requested. Awards are expected to begin on or about June 1, 2001.

Technical information on CCPP is available on the World Wide Web at the URL: <http://www.sc.doe.gov/production/OBER/GC/model.html> or from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, telephone (423) 576-8401.

The Catalog of Federal Domestic Assistance Number for this program is 81.049, and the solicitation control number is ERFAP 10 CFR Part 605.

John Rodney Clark
Associate Director of Science
for Resource Management

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