Office of Science
Financial Assistance
Funding Opportunity Announcement
DE-FOA-0000452

SciDAC: Earth System Model Development

SUMMARY:

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 for Earth System Modeling (ESM) projects as part of the SciDAC (Scientific Discovery through Advanced Computing) program with DOE's Office of Advanced Scientific Computing Research (ASCR). The SciDAC program fosters integration of high performance computing and computational science throughout all mission areas within SC. This opportunity addresses collaborative research to enhance climate model resolution, physical representation of processes, validation, and quantification of uncertainty. All projects should be relevant to the objectives of the Earth System Modeling program (http://www.science.doe.gov/ober/CESD/esm.html) within BER's Climate and Environmental Sciences Division (CESD). The relevant temporal scales of interest to the program range from decades to centuries.

In order to advance the simulation and predictive capabilities of state-of-science climate models, new approaches are needed to increase the spatial resolution, develop and incorporate refinements to physical process representation, and enhance quantification of uncertainty and model validation. National investments in computer science and petascale computing in recent decades have enabled DOE science to be at the forefront of many areas of the physical sciences. DOE's SciDAC program (http://www.science.doe.gov/ascr/Research/SciDAC.html) is intended to couple these investments in computer science and leadership class computing with scientists from across the major program offices within DOE's Office of Science. This FOA is to facilitate direct collaboration between computational scientists and climate model developers to enable breakthroughs in climate model simulation and prediction.

The BER ESM program aims to advance all aspects of climate science that leads to improved predictability of the earth climate for higher resolution and with reduced uncertainty. The first goal is to improve the accuracy and skill of climate models by implementing enhanced ESM components, such as improved parameterizations for clouds, aerosols and chemistry, carbon cycle modeling, land surface processes, and sea and land ice representation. Development of these model components are expected to be accompanied by comparison with scale-appropriate measurements. A second goal is to understand the principle causes and effects of climate change, including potential abrupt changes in climate. Further information on the ESM program priorities within CESD may be found at: http://www.sc.doe.gov/ober/Climate%20Strategic%20Plan.pdf. High risk, high pay-off research ideas that explore innovative new directions to advance the understanding, simulation and prediction of climate change are encouraged. Applications should

clearly describe how the proposed ideas have the potential to lead to breakthroughs in earth system modeling.

Availability of advanced computer resources at DOE facilities provides unique opportunities to enhance earth system model component development. CESD will continue to support climate models based on definitive theoretical foundations and improved computational methods that run efficiently on current petascale and future high performance supercomputers.

PREAPPLICATIONS

Potential applicants are **required** to submit a brief preapplication, referencing **DE-FOA-0000452** for receipt by DOE by **4:30 p.m**., Eastern Time, **January 24, 2011**. Preapplications will be reviewed for conformance with the guidelines presented in the FOA and suitability in the technical areas specified. A response to the preapplications encouraging or discouraging formal applications will be communicated to the applicants by **February 7, 2011**. Applicants who have not received a response regarding the status of their preapplication by this date are responsible for contacting the program to confirm this status.

Only those preapplicants that receive notification from DOE encouraging a formal application may submit full applications. **No other formal applications will be considered.** Preapplications referencing **DE-FOA-0000452** should be sent as PDF file attachments via e-mail to: SCSciDAC.model2011@science.doe.gov with **"Preapplication DE-FOA-0000452"** as the subject. **No FAX or mail submission of preapplications will be accepted.**

Potential applicants must submit a brief preapplication that consists of two to three pages of narrative describing the research objectives, the technical approach(s), and the proposed team members and their expertise. The intent in requesting a preapplication is to save the time and effort of applicants in preparing and submitting a formal project application that may be inappropriate for the program. Preapplications will be reviewed relative to the scope and research needs as outlined in the summary paragraph and in the SUPPLEMENTARY INFORMATION. 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 amount of funding requested for each year for the project for each funded institution. No biographical data need be included, nor is an institutional endorsement necessary.

APPLICATION DUE DATE: March 21, 2011, 11:59 PM Eastern Time.

Formal applications submitted in response to this FOA must be received by March 21, 2011, 11:59 p.m. Eastern time, to permit timely consideration of awards. **APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

IMPORTANT SUBMISSION INFORMATION: The full text of the Funding Opportunity Announcement (FOA) is located on FedConnect. Instructions for completing the Grant Application Package are contained in the full text of the FOA which can be obtained at: https://www.fedconnect.net/FedConnect/?doc=DE-FOA-0000452&agency=DOE . To search for the FOA in FedConnect click on "Search Public Opportunities". Under "Search Criteria", select "**SciDAC: Earth System Model Development**", then click on "Search". Once the screen comes up, locate the appropriate FOA.

In order to be considered for award, Applicants must follow the instructions contained in the FOA.

WHERE TO SUBMIT: Applications must be submitted through Grants.gov to be considered for award.

You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements carefully and start the process immediately. Remember you have to update your CCR registration annually. If you have any questions about your registration, you should contact the Grants.gov Helpdesk at 1-800-518-4726 to verify that you are still registered in Grants.gov.

Registration Requirements: There are several one-time actions you must complete in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider, and register with Grants.gov). See http://www.grants.gov/GetStarted. Use the Grants.gov Organization Registration Checklist at http://www.grants.gov/assets/OrganizationRegCheck.pdf to guide you through the process. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in the CCR registration process. Applicants, who are not registered with CCR and Grants.gov, should allow at least 21 days to complete these requirements. It is suggested that the process be started as soon as possible.

IMPORTANT NOTICE TO POTENTIAL APPLICANTS: When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e. Grants.gov registration).

Questions: Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. Part VII of the FOA explains how to submit other questions to the Department of Energy (DOE).

All applications should be in a single PDF file.

GENERAL INQUIRIES ABOUT THIS FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) SHOULD BE DIRECTED TO:

Technical/Scientific Program Contact:

Program Manager: Dr. Dorothy Koch
U. S. Department of Energy
Office of Biological and Environmental Research
Climate and Environmental Sciences Division
Earth System Modeling
Phone: 301-903-0105
E-Mail: dorothy.koch@science.doe.gov

Program Manager: Dr. Renu Joseph
U. S. Department of Energy
Office of Biological and Environmental Research
Climate and Environmental Sciences Division
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Merit Review

Applications will be subjected to scientific 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; and
5. High Risk/High Reward Potential.

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

PROGRAM FUNDING: It is anticipated that up to $3,000,000 will be available for multiple awards to be made in Fiscal Year 2011, contingent on the availability of appropriated funds. Applications may generally request project support up to three years, with out-year support contingent on the availability of funds, progress of the research and programmatic needs. DOE is under no obligation to pay for any costs associated with preparation or submission of applications.

SUPPLEMENTARY INFORMATION: The CESD Long Term Measure 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.*

To accelerate the science in support of the Long Term Measure, applications focused on the development of model components and/or high resolution formulations for Earth System Models are solicited.

Research applications in response to this FOA may therefore focus on improving climate system models and/or their components to make them more accurate and computationally efficient. This may include improved or new process representation of the physical and biogeochemical components, and/or numerical formulations for high resolution modeling. Examples could include development of components or development of scale-aware parameterizations for atmospheric, oceanic, terrestrial or cryospheric systems. High-resolution formulations could include unstructured and/or adaptive grids or other innovative techniques for resolving convection/eddy dynamics. Projects may include focus on ESM component coupling and exchange.

Modeling projects that focus on the development of model components relevant to extreme shifts in the climate system or abrupt climate change are also encouraged. Relevant topics include investigations of major changes in the hydrologic system such as megadroughts, changes in the meridional ocean circulation, thawing of Arctic permafrost, melting of sea ice, and destabilization of ice sheets. Proposed research applications are strongly encouraged to address the following activities: articulating the thresholds, nonlinearities and fast feedbacks in the climate system with a focus on abrupt climate change, incorporating causal mechanisms into coupled climate models and testing the enhanced models against observational records of (post Last Glacial Maximum) past abrupt climate change.

A requirement of the SciDAC program is close coordination/collaboration with computational scientists. Ideal projects will include a multidisciplinary collaborative team of climate, mathematical and/or computational scientists. The collaboration should enable the development of cutting-edge algorithms and mathematical approaches designed to maximize use of current petascale computer architectures for enhancing climate modeling or evaluation. Possible foci of these collaborative efforts could include for example, development of new climate model components designed for current computer architectures, improvement of existing codes to enhance computer performance, development of model and/or observational visualization and data management systems, development of frameworks to provide model uncertainty quantification. Applicants should demonstrate the role of their proposed research in improving the accuracy and/or computational efficiency of ESMs envisioned for use in making forecasts of long-term climatic change. The projects should have a single lead investigator with clearly defined coordination among the team’s science climate, mathematical and computer scientists.

Proposed projects that would integrate across DOE/BER research programs are particularly encouraged. This could be achieved by developing model components within community models like the Community Earth System Model (CESM), or by developing modular ESM components

with a clear plan for implementation in the CESM within the project term. Model development may also link to developments within other CESD programs (http://www.science.doe.gov/ober/CESD_top.html) such as the Regional and Global Climate Modeling, Atmospheric Systems Research or Terrestrial Ecosystems Science or Integrated Assessment Programs. Applications should clearly describe how their research contributes measurably to the broad areas mentioned above. It should explicitly state and indicate how the project will be relevant to the Long Term Measure. Applications should also include a clear plan for the dissemination of any developed model code, and necessary documentation, to the climate modeling community.

To ensure that the CESD Modeling Program meets both the broad needs of the climate modeling research community and the specific needs of the CESD, successful investigators will participate in the annual Science Team meeting. Costs for participation in the Science Team annual meeting and workshops should be included in each application. Yearly estimates for Science Team travel should be based on one trip of five days to Washington, DC.

It is anticipated but not guaranteed that successful PIs will obtain computing resources at various DOE National Laboratories to achieve the proposed scientific objectives, e.g., through proposals to the National Energy Research Scientific Computing (NERSC, http://www.nersc.gov/) and other Leadership Computing Facilities.

DATA SHARING POLICY:

Research data obtained through public funding are a public trust. As such, these data must be publicly accessible. To be in compliance with the data policy of the U.S. Global Change Research Program of full and open access to global change research data, applications submitted in response to this FOA must include a description of the applicant's data sharing plans if the proposed research involves the acquisition of data in the course of the research that would be of use to the climate change research and assessment communities. This includes data from extensive, long-term observations and experiments and from long-term model simulations of climate that would be costly to duplicate. The description must include plans for sharing the data that are to be acquired in the course of the proposed research, particularly how the acquired data will be preserved, documented, and quality assured, and where they will be archived for access by others. Data of potentially broad use in climate change research and assessments should be archived, when possible, in data repositories for subsequent dissemination. Examples of DOE-funded data repositories may be found at http://cdiac.ornl.gov/, http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php. The repository where the applicant intends to archive the data should be notified in advance of the intention, contingent on a successful outcome of the application review. If data are to be archived at the applicant's home institution or in some other location, the application must describe how, where, and for how long the data will be documented and archived for access by others. Applicants are allowed an initial period of exclusive use of the acquired data to quality assure it and to publish papers based on the data, but they are strongly encouraged to make the data openly available as soon as possible after this period. DOE's Office of Biological and Environmental Research defines the exclusive use period to be one year after the end of the data acquisition period for the proposed performance period of

the grant application but exceptions to extend this period may be justified for unique or extenuating circumstances.

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

Posted on the Office of Science Grants and Contracts Web Site
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