

# **Program Announcement To DOE National Laboratories LAB 10-05**

## ***Earth System Modeling: Advanced Scientific Visualization of Ultra-Large Climate Data Sets***

### **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 peer-reviewable Field Work Proposals (FWPs) in the development of advanced scientific visualization tools relevant to simulations of the earth system.

BER's strategy for basic research in climate science is described in a recent strategic plan (<http://www.sc.doe.gov/ober/Climate%20Strategic%20Plan.pdf>). BER encourages potential researchers to review this plan to familiarize themselves with the program and its strategic goals. BER-supported climate change research seeks to generate the scientific knowledgebase needed to (i) inform the public discussion related to climate change; (ii) support scientific considerations of energy policy options related to climate change; and (iii) provide the scientific foundations and tools that can be used by the nation to plan for, adapt to, and mitigate climate change. Ultimately, Earth System Models, the next-generation climate models that incorporate biogeochemistry, atmospheric chemistry and dynamic vegetation into coupled models of the atmosphere, ocean, sea ice, and land surface, must provide improved simulations of temperature, precipitation, and extreme weather events, all at much finer scales.

All proposals submitted in response to this Announcement must explicitly state how the proposed project will support the accomplishment of the BER climate science Long Term Measure 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."

### **DATES:**

Full proposals submitted in response to this Announcement must be received no later than Monday, 8:00 pm ET, February 22, 2010, to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2010

Please see the "Addresses" section below for further instructions on the method of submission for the proposal.

### **ADDRESSES and SUBMISSION INSTRUCTIONS:**

Have your LAB administrator submit the entire LAB proposal and FWP via Searchable FWP (<https://www.osti.gov/fwp>). If you have questions about who your LAB administrator is or how to use Searchable FWP, please contact the Searchable FWP Support Center.

Please submit, via Federal Express, a single PDF file of the entire LAB proposal and FWP on a CD along with two hard copies to the address below. This will assist in expediting the review process.

**Please send the CD and 2 hard copies via Federal Express to:**

Karen Carlson-Brown  
Climate and Environmental Sciences Division, SC-23.1  
Office of Biological and Environmental Research  
Office of Science  
19901 Germantown Road  
Germantown, MD 20874-1290  
ATTN: Program Announcement LAB 10-05

**FOR FURTHER INFORMATION CONTACT:**

Ashley Williamson  
Program Manager  
Earth System Modeling Program  
Climate and Environmental Sciences Division  
Office of Biological and Environmental Research  
(301) 903-3120 (telephone)  
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**SUPPLEMENTARY INFORMATION:**

In FY 2010 BER will address the following topic in earth system modeling:

**Advanced Scientific Visualization of Ultra-High Climate Data Sets**

As outlined in the Workshop report on Scientific Grand Challenges: Challenges in Climate Change Science and the Role of Computing at the Extreme Scale (<http://www.sc.doe.gov/ober/ClimateReport.pdf>), existing techniques, tools and algorithms are not suitable for use on large data sets. For example, existing visual data analysis algorithms are not effective for studying the relationships between the dozens or hundreds of runs produced in a single ensemble or for comparative analysis of dozens or hundreds of ensemble runs. Other examples include the need to discover and understand the relationships between variables in a time-evolving data, comparing simulation and experiment/observed data and comparing/understanding data that exist on different grid types and have different resolutions.

The DOE Leadership-class Computing Facility greatly enhances the research community's ability to undertake long-term simulations of climate and earth system models at high spatial and temporal resolutions. In order to accelerate understanding of the earth system, the ability to analyze model output needs to keep pace with the voluminous model output of high-resolution simulations. Through this Program Announcement, DOE solicits proposals for the development

of new onsite and remote-access tools in advanced visualization. Proposals that enable users to render the data in a form that displays the evolution of the climate state variables and to provide powerful tools for testing hypotheses are encouraged. Proposals that provide access to multiple data sources, e.g., model output and observational, in an integrated framework are particularly encouraged.

As earth system models are run at increasingly high resolution, vast amounts of data are generated. There is a need for advanced visualization tools to be developed through partnerships between climate scientists and computational scientists. These advanced visualization tools will effectively render the data in a form researchers can use for testing hypotheses and intercomparisons, both model-model as well as model-observations. Such synthesis and comparison of observations and model output will facilitate both model improvement as well as guide the next generation of field experiments and measurements. Thus development of a unified data base of observational data (e.g., ARM) and earth system model data is encouraged.

Proposed research is intended to fill critical knowledge gaps, including the exploration of some high-risk approaches. BER also encourages the submission of innovative "high-risk" proposals with potential for future high impact on advanced scientific visualization of ultra large climate data sets. The probability of success and the risk-reward balance will be considered when making funding decisions.

**Data Sharing Policy:** Research data obtained through public funding is 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, proposals submitted in response to this Announcement must include a description of the researcher'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 is to be acquired in the course of the proposed research, particularly how the acquired data will be preserved, documented, and quality assured, and where it 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](http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php). The repository where the researcher intends to archive the data should be notified in advance of the intention, contingent on a successful outcome of the proposal review. If data are to be archived at the researcher's home institution or in some other location, the proposal must describe how, where, and for how long the data will be documented and archived for access by others. Researchers 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 award but exceptions to extend this period may be justified for unique or extenuating circumstances.

## **Program Funding:**

Contingent on the availability of FY 2010 appropriated funds, it is anticipated that a total of \$5,000,000 will be available for the development of advanced scientific visualization tools for ultra large climate data sets. It is anticipated that at least two awards will be made.

Proposals may request project support up to 3 years, with out-year support contingent on the availability of funds, progress of the research, and programmatic needs. Annual budgets for each proposal should not exceed \$2,500,000 million total costs. Funds for this research will come from the Earth System Modeling program. DOE is under no obligation to pay for any costs associated with preparation or submission of proposals. DOE reserves the right to fund, in whole or in part, any, all, or none of the proposals submitted.

All proposals submitted in response to this Announcement must explicitly state how the proposed project will support accomplishment of the BER climate science activity Long Term Measure 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."

## **Eligibility:**

This is a DOE LAB-only Announcement. FFRDCs from other federal agencies are not eligible to submit in response to this Announcement. Partnerships between DOE LABs and other appropriate institutions are encouraged, as appropriate. For multi-lab proposals, a complete proposal with all collaborating parts should be submitted by the lead LAB. No individual submissions by university partnerships should be sent via grants.gov at this stage.

## **SUBMISSION INFORMATION:**

The research project description **must be 20 pages or less**, exclusive of attachments and the required one-page abstract (see below). All collaborators should be listed with the abstract or summary. Attachments include curriculum vitae, a listing of all current and pending federal support and letters of intent when collaborations are part of the proposed research. Curriculum vitae should be limited to no more than two pages per individual.

The following is a list of essential items that a proposal must contain:

- 1. Field Work Proposal (FWP) Format** - Complete and signed by appropriate officials.
- 2. Proposal Cover Page**
- 3. Table of Contents**
- 4. Budget Page(s)** (Form DOE F 4620.1) - Complete a separate Budget Page for the entire multi-year period for each separate participating institution, if applicable.  
<http://www.science.doe.gov/grants/budgetform.pdf>

**5. Budget Description and Justification** - Separately for each collaborating institution if applicable.

## **6. Other Project Information**

**a. A one-page abstract** (on a page by itself): The abstract must include, at the top of the page: the (lead) DOE National Laboratory, title of the project, name of the principal investigator (PI), the PI's telephone number and e-mail address, and a list of all collaborating investigators (if any) and their institutions. The abstract must provide a summary of the project narrative, including the technical qualifications of the principal investigator.

**b. Project Narrative (20 pages maximum):** The project narrative must include a detailed description of the proposed research project, which must include a list of project milestones, a timeline of key activities, and clear statements of which project personnel will be responsible for each key activity.

**c. Bibliography:** A complete bibliographic listing of all the published scientific and engineering literature referred to in the project narrative.

**d. Biographical Sketches:** Relevant information about the background and experience of the principal investigator and co-principal investigators or collaborators (if any). Biographical sketches are limited to two pages per individual.

**e. Facilities and Resources:** Include information on the experience of the proposing institution(s), their facilities, and the available resources that would be relevant to successful completion of the project.

**f. Statement of all current and pending support** for the principal investigator and co-principal investigators and collaborators (if any), including the time devoted (each year) to each project by each named individual.

The instructions and format described below must be followed. You must reference Program Announcement LAB 10-05 on all submissions and inquiries about this Program Announcement.

### **OFFICE OF SCIENCE GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS TO BE SUBMITTED BY NATIONAL LABORATORIES**

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this Program Announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

## **1. Evaluation Criteria**

After an initial screening for eligibility and responsiveness to this Announcement, proposals will be subjected to a formal scientific merit review (peer review). The proposals will be evaluated against the following criteria, which are listed in descending order of importance:

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

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 a proposal constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

## **2. Summary of Proposal Contents**

- Field Work Proposal (FWP) Format (Reference DOE Order 412.1A) (DOE ONLY)
- Proposal Cover Page
- Table of Contents
- Budget (DOE Form 4620.1) and Budget Explanation
- Abstract (one page)
- Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel - 20-page limit)
- Literature Cited
- Biographical Sketch(es)
- Description of Facilities and Resources
- Other Support of Investigator(s)
- Appendix (optional)

### **2.1 Submission Instructions**

Have your LAB administrator submit the entire LAB proposal and FWP via Searchable FWP (<https://www.osti.gov/fwp>). If you have questions about who your LAB administrator is or how to use Searchable FWP, please contact the Searchable FWP Support Center.

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Karen Carlson-Brown  
Climate and Environmental Sciences Division, SC-23.1  
Office of Biological and Environmental Research

Office of Science  
19901 Germantown Road  
Germantown, MD 20874-1290  
ATTN: Program Announcement LAB 10-05

**For further information contact:**

Anjuli Bamzai, Ph.D.  
Program Manager  
Earth System Modeling Program  
Climate and Environmental Sciences Division  
Tel: (301) 903-0294  
Email: Anjuli.Bamzai@science.doe.gov

**3. Detailed Contents of the Proposal**

Adherence to type size and line spacing requirements is necessary for several reasons. No researcher should have the advantage, or by using small type, of providing more text in his or her proposal. Small type may also make it difficult for reviewers to read the proposal. Proposals must have 1-inch margins at the top, bottom, and on each side. Type sizes must be at least 11 point. Line spacing is at the discretion of the researcher but there must be no more than 6 lines per vertical inch of text. Pages should be standard 8 1/2" x 11" (or metric A4, i.e., 210 mm x 297 mm).

**3.1 Field Work Proposal Format (Reference DOE Order 412.1A) (DOE ONLY)**

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review.

**3.2 Proposal Cover Page**

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project  
SC Program announcement title  
Name of laboratory  
Name of principal investigator (PI)  
Position title of PI  
Mailing address of PI  
Telephone of PI  
Fax number of PI  
Electronic mail address of PI  
Name of official signing for laboratory\*  
Title of official  
Fax number of official  
Telephone of official  
Electronic mail address of official

Requested funding for each year; total request

Use of human subjects in proposed project:

If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.

Use of vertebrate animals in proposed project:

If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.

Signature of PI, date of signature

Signature of official, date of signature\*

\*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

### **3.3 Table of Contents**

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages, and do not use suffices, such as 5a, 5b.

### **3.4 Budget and Budget Explanation**

A detailed budget is required for the entire project period and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information\*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

\* Form 4620.1 is available at web site: <http://www.science.doe.gov/grants/budgetform.pdf>

### **3.5 Abstract**

Summarize the proposal in one page. Give the project objectives (in broad scientific terms), the approach to be used, and what the research is intended to accomplish. State the hypotheses to be tested (if any). At the top of the abstract give the lead DOE national Laboratory, project title,

names of all the investigators and their institutions, and contact information for the principal investigator, including e-mail address.

**3.6 Narrative** (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel).

The narrative comprises the research plan for the project and is limited to **20 pages (maximum)**. It should contain enough background material in the Introduction, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the methods to be used. It should also include a timeline for the major activities of the proposed project, and should indicate which project personnel will be responsible for which activities. It is important that the 20-page technical information section provide a complete description of the proposed work, because reviewers are not obliged to read the Appendices. Proposals exceeding these page limits may be rejected without review.

All proposals submitted in response to this LAB Announcement must explicitly state how the proposed project will support the accomplishment of the BER climate science Long Term Measure.

If any portion of the project is to be done in **collaboration** with another institution (or institutions), provide information on the institution(s) and what part of the project it will carry out. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation," "Biographical Sketches," and "Description of Facilities and Resources."

### **3.7 Literature Cited**

Give full bibliographic entries for each publication cited in the narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Principal investigators should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the proposal.

### **3.8 Biographical Sketches**

This information is required for senior personnel at the institution submitting the proposal and at all subcontracting institutions (if any). The biographical sketch is limited to a maximum of two pages for each investigator and must include:

*Education and Training.* Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

*Research and Professional Experience.* Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications. Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than five professional and scholarly activities related to the effort proposed.

To assist in the identification of potential conflicts of interest or bias in the selection of reviewers, the following information must also be provided in each biographical sketch.

Collaborators and Co-editors: A list of all persons in alphabetical order (including their current organizational affiliations) who are currently, or who have been, collaborators or co-authors with the investigator on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of the proposal. Also, include those individuals who are currently or have been co-editors of a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of the proposal. Finally, list any individuals who are not listed in the previous categories with whom you are discussing future collaborations. If there are no collaborators or co-editors to report, this should be so indicated.

Graduate and Postdoctoral Advisors and Advisees: A list of the names of the individual's own graduate advisor(s) and principal postdoctoral sponsor(s), and their current organizational affiliations. A list of the names of the individual's graduate students and postdoctoral associates during the past five years, and their current organizational affiliations.

### **3.9 Description of Facilities and Resources**

Facilities to be used for the conduct of the proposed research should be briefly described. Indicate the pertinent capabilities of the institution, including support facilities (such as machine shops), that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution (if any).

### **3.10 Other Support of Investigators**

Other support is defined as all financial resources, whether Federal, non-Federal, commercial, or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort (months per year or percentage of the year) devoted to the project.

### **3.11 Appendix**

Information not easily accessible to a reviewer may be included in an appendix, but **do not use the appendix to circumvent the page limitations of the proposal**. Reviewers are not required to consider information in an appendix, and reviewers may not have time to read extensive appendix materials with the same care they would use with the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts accepted for publication, abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

#### **4. Detailed Instructions for the Budget**

(DOE Form 4620.1 "Budget Page" may be used).

##### **4.1 Salaries and Wages**

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

##### **4.2 Equipment**

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$50,000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

##### **4.3 Domestic Travel**

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

##### **4.4 Foreign Travel**

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

#### **4.5 Other Direct Costs**

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

##### **a. Materials and Supplies**

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

##### **b. Publication Costs/Page Charges**

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

##### **c. Consultant Services**

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

##### **d. Computer Services**

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

##### **e. Subcontracts**

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

#### **4.6 Indirect Costs**

Explain the basis for each overhead and indirect cost. Include the current rates.