

Decadal and Regional Climate Prediction using Earth System Models (EaSM)

PROGRAM SOLICITATION NSF 10-554



National Science Foundation

Directorate for Geosciences

Directorate for Mathematical & Physical Sciences

Directorate for Biological Sciences

Directorate for Computer & Information Science & Engineering

Directorate for Social, Behavioral & Economic Sciences

Office of Cyberinfrastructure

Office of Polar Programs



U.S. Dept. of Agriculture



U.S. Dept. of Energy

Office of Science, Office of Biological and Environmental Research

Letter of Intent Due Date(s) (required) (due by 5 p.m. proposer's local time):

May 24, 2010

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

June 25, 2010

IMPORTANT INFORMATION AND REVISION NOTES

Please be advised that the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: *Grant Proposal Guide* Chapter II for further information about the implementation of this new requirement).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Decadal and Regional Climate Prediction using Earth System Models (EaSM)

Synopsis of Program:

The consequences of climate variability and change are becoming more immediate and profound than previously anticipated. Important impacts, such as the onset of prolonged droughts on several continents, increasing stresses on natural and managed ecosystems, loss of agricultural and forest productivity, altered biological feedbacks, degraded ocean and permafrost habitats, global sea level rise and the rapid retreat of ice sheets and glaciers, loss

of Arctic sea ice, and changes in ocean currents, have highlighted that climate variability and change can have significant effects on decadal and shorter time scales, with significant consequences for plant, animal, human, and physical systems.

This activity enables interagency cooperation on one of the most pressing problems of the millennium--climate change--how it is likely to affect our world, and how we can proactively plan for its consequences. It allows the partner agencies--National Science Foundation (NSF), U.S. Department of Agriculture (USDA), and U.S. Department of Energy (DOE)--to combine resources to identify and fund the most meritorious and highest-impact projects that support their respective missions, while eliminating duplication of effort and fostering collaboration between agencies and the investigators they support.

This interdisciplinary grand challenge calls for the development of next-generation Earth System Models that include coupled and interactive representations of ecosystems, agricultural working lands and forests, urban environments, biogeochemistry, atmospheric chemistry, ocean and atmospheric currents, the water cycle, land ice, and human activities. The realization of these goals demands the engagement of diverse interdisciplinary teams of experimental, theoretical, modeling and computational researchers, including but not limited to, biologists, chemists, computer scientists, geoscientists, material scientists, mathematicians, physicists, cyberinfrastructure specialists, and social scientists. Successful proposals will develop intellectual excitement in the participating disciplinary communities. Also encouraged are proposals that promoted diversity and have broad educational or societal impacts that capitalize on this interdisciplinary opportunity.

Competitive projects should address key problems critical to linking relevant Earth system processes over a variety of spatial and temporal scales and to advancing the theoretical foundations for the modeling and simulation of existing data and data collected by the new and envisioned NSF environmental observatories. Proposals are encouraged that have the potential to dramatically improve our predictive capabilities as well as our understanding of how small and large scale processes lead to non-linearities and activation thresholds.

The specific goals of this solicitation are to improve upon and extend current modeling capabilities in order to:

1. Achieve comprehensive, reliable global and regional predictions of decadal climate variability and change through advanced understanding of the coupled interactive physical, chemical, biological and human processes that drive the climate system.
2. Quantify the impacts of climate variability and change on ecological, agricultural and other human systems, and identify and quantify feedback loops through which human systems help determine environmental outcomes.
3. Maximize the utility of available observational and model data for impact and vulnerability/resilience assessments through up/downscaling activities.
4. Effectively translate model results and associated uncertainties into the scientific basis for well-informed human adaptation to and management decisions for climate change.

Two types of proposals--incubator/capacity building activities (Type 1) and large collaborative interdisciplinary research projects (Type 2)--are solicited. Please refer to Section II, Program Description, for additional information about the two categories of proposals.

Cognizant Program Officer(s):

- Jay Fein, GEO/AGS, telephone: (703) 292-8527, email: jfein@nsf.gov
- Eric C. Itsweire, Directorate for Geosciences (GEO), telephone: (703) 292-8582, email: eitsweir@nsf.gov
- Thomas F. Russell, Directorate for Mathematical & Physical Sciences (MPS), telephone: (703) 292-4863, email: trussell@nsf.gov
- Tanja Pietras, Directorate for Mathematical & Physical Sciences (MPS), telephone: (703) 292-2170, email: tpietras@nsf.gov
- Robert Sanford, telephone: (703) 292-7120, email: rsanford@nsf.gov
- Elizabeth R. Blood, Directorate for Biological Sciences (BIO), telephone: (703) 292-8470, email: eblood@nsf.gov
- John Cozzens, Directorate for Computer & Information Science & Engineering (CISE), telephone: (703) 292-8910, email: jcozzens@nsf.gov
- Rita Teutonico, OAD/SBE, telephone: (703) 292-7118, email: rteutoni@nsf.gov
- Cheryl L. Eavey, Directorate for Social, Behavioral & Economic Sciences (SBE), telephone: (703) 292-7269, email: ceavey@nsf.gov
- Philip Bogden, Office of Cyberinfrastructure (OCI), telephone: (703) 292-7092, email: pbogden@nsf.gov
- Irene Qualters, telephone: (703) 292-2339, email: iqualter@nsf.gov
- Erica Key, Office of Polar Programs (OPP), telephone: (703) 292-8029, email: ekey@nsf.gov
- Peter Milne, OPP, telephone: (703) 292-4714, email: pmilne@nsf.gov
- Luis Tupas, US Department of Agriculture, National Institute of Food and Agriculture (USDA-NIFA), telephone: (202) 401-4926, email: ltupas@nifa.usda.gov
- Renu Joseph, Department of Energy, Office of Science (DOE-SC), Office of Biological and Environmental Research, telephone: (301) 903-9237, email: Renu.Joseph@science.doe.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.049 --- Mathematical and Physical Sciences
- 47.050 --- Geosciences
- 47.070 --- Computer and Information Science and Engineering

- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences
- 47.078 --- Office of Polar Programs
- 47.080 --- Office of Cyberinfrastructure
- 81.049 --- Office of Science Financial Assistance Program

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 20 to 30 depending on the mix and size of projects submitted to the two proposal classes (Type 1 and Type 2, see explanations in the Program Description for this solicitation). A total of 15 to 20 awards in the Type 1 (Capacity/Community Building) class and 6 to 10 awards in the Type 2 (Full Research Project) class will be made. This estimate is the total for all funding sources (NSF, USDA, and DOE) combined.

Anticipated Funding Amount: \$45,000,000 to \$50,000,000 is available in FY 2010, subject to availability of funds.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs): Contact the appropriate program before preparing a proposal for submission.
- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

PI Limit:

PIs from NSF-funded FFRDCs may submit proposals to this competition. Projects involving USDA or DOE FFRDCs or National Laboratories will only be considered for co-funding by NSF if they are collaborative efforts that include non-federally funded institutions. To facilitate possible interagency funding of such collaboratives, an institution other than the USDA or DOE FFRDC must serve as the lead institution. This is necessitated solely by NSF rules for funding collaborative grants and should not be construed as a comment on capability or leadership. Proposals for FFRDCs must obey NSF budget guidelines and may not include costs already covered by federal funds.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

An individual may appear as Principal Investigator (PI), co-PI, or other senior personnel on **only one Type 2 proposal** in response to this solicitation (the submission limit does not apply to Type 1 proposals). This limitation includes proposals submitted by a lead organization, any sub-award submitted as part of a proposal, or any collaborative proposal. If an individual is listed as PI, co-PI, or senior personnel on more than one proposal, all of those proposals will be returned without review.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposals:**
 - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
 - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.
- **Indirect Cost (F&A) Limitations:**

Institutional overhead cannot be charged on costs for facilities normally covered by NSF and/or DOE-SC for unsolicited proposals. These include but are not limited to fee for use computing and other similar shared-use facility expenses. Questions regarding costs and use of these or other NSF or DOE-SC shared-use facilities should be directed to one of the NSF or DOE-SC program directors named in the solicitation.

For awards made by USDA-NIFA, Section 1462(a) of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. 3310(a)) limits the recovery of indirect costs to 22 percent of total federal funds awarded. Revised budgets will be solicited if these guidelines are not met by an application to be awarded by USDA-NIFA.

- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. proposer's local time):

May 24, 2010

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

June 25, 2010

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions: Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements: Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

Climate prediction at decadal and shorter timescales is a scientific grand challenge that underscores the complexity of the Earth system while also highlighting the many unknowns that shape our climate. These include natural drivers of climate variability; the transient sensitivity of the climate system to radiative forcing; short-lived greenhouse gases such as ozone and methane, and particles affecting the Earth's albedo such as soot, clouds, and aerosols; the roles of oceanic and terrestrial ecosystems, land use,

and biogeochemical cycles; and feedbacks between societal behavior and climate. The nonlinear nature of these interactions greatly increases the complexity of the problem.

Additional challenges are faced in the development and applications of the models themselves. These include scaling, model parameterization, uncertainty quantification, model validation, more efficient algorithms, and realistic representation of underlying biogeochemical, physical, chemical, agricultural, ecological, and socioeconomic processes. Further problems arise in model initialization and climate change attribution when the sparseness and heterogeneity of available data are considered. Computational and mathematical expertise is needed to optimize the merging of available data towards the development of equilibrium climate states for model initialization. Cyberinfrastructure research can advance the development of novel computational paradigms, including abstraction layers and frameworks. As these many issues are addressed, the new knowledge generated becomes the basis for continuing improvements in the reliability of future, more complete versions of Earth System Models.

Grand challenges such as these cannot be met in isolation. Diverse teams of researchers involved in parallel, interdisciplinary, and complementary activities are required to advance the field of Earth System Modeling. Cyberinfrastructure should be utilized to support the development, growth, and effectiveness of collaborating teams while also supplying shared computer and data platforms to a wide range of users of climate and climate impacts predictions and information. It is anticipated that projects funded by EaSM will yield more than incremental results in individual models, but instead will transform the conduct of climate science, greatly increasing the impact of research outcomes.

II. PROGRAM DESCRIPTION

This solicitation will capitalize on the synergy between development of climate models, their use in both the assessment and attribution of climate variability and impacts, and the development of approaches to effectively inform adaptation policy. The overall goal of the EaSM solicitation is to improve upon and expand on current modeling capabilities in order to substantively contribute to the advancement of reliable regional and decadal climate predictions. Specific goals are to:

1. Achieve comprehensive, reliable global and regional predictions of decadal climate variability and change through advanced understanding of the coupled interactive physical, chemical, biological and human processes that drive the climate system.
2. Quantify the impacts of climate variability and change on ecological, agricultural and other human systems, and identify and quantify feedback loops through which human systems help determine environmental outcomes.
3. Maximize the utility of available observational and model data for impact and vulnerability/resilience assessments through up/downscaling activities.
4. Effectively translate model results and associated uncertainties into the scientific basis for well-informed human adaptation to and management decisions for climate change.

Two categories of proposals will be entertained. For both types of proposals, efforts should be made to leverage existing modeling frameworks and existing cyberinfrastructure as appropriate, and to encourage the participation of postdoctoral and early career scientists.

Type 1 Proposals: Type 1 proposals should describe incubator and capacity/community building activities that focus on specific outcomes that address one or more goals of the solicitation. Efforts might include the formation of new interdisciplinary partnerships that formulate and explore fresh, innovative research strategies that could be developed into Type 2 projects. Type 1 projects may also include exploratory pilot research projects aligned with the program goals. Type 1 proposals may be up to 3 years in duration and range up to \$300,000 per year. Please note that standard one-time workshop proposals will not be entertained in this competition and that the National Institute of Food and Agriculture at USDA (USDA-NIFA) does not intend to fund Type 1 proposals.

Type 2 Proposals: Type 2 proposals should describe large, ambitious, collaborative, inter/multidisciplinary efforts that advance the state of Earth System Modeling on regional and decadal scales. Proposers should clearly state how their efforts contribute to the overall goals of the program. Where appropriate, investigators are encouraged to incorporate methods and metrics that assess the reliability of predictions. It is anticipated that typical Type 2 projects will be 3 to 5 years in duration, with budgets in the range of \$300,000 to \$1,000,000 per year.

Included within the scope of this solicitation, specific aspects of Earth System Modeling on decadal and regional scales are of particular interest to NSF, USDA-NIFA, and DOE.-SC

NSF Areas of Interest:

Several current models can reproduce the evolution and global patterns of climate change over the past century but considerable uncertainty remains concerning their ability to predict with precision the long-term (end of century) climate outcomes of greenhouse warming. However, with some exceptions, climate models are inconsistent on continental and smaller scales in predicting the degree of intensity of change, as is the case with sea level rise, and in other cases such as precipitation, even the direction of change on more immediate time scales.

This solicitation is intended to support development of reliable regional and decadal climate predictions that take into account the influences of living systems and are also essential for projecting how living systems might adapt to climate change and its consequences for their physical environment. These predictions are necessary for well-informed human adaptation to climate change in planning future infrastructure, ensuring adequate food and water supplies, and developing sound, informed policy and stewardship for our natural and managed ecosystems. Examples of NSF areas of interest are:

- Research to improve climate system models and/or their component models that lead to comprehensive Earth System Models that are more accurate and computationally efficient. This may include: improved process representation, new components, numerical modeling of non-linear processes, and novel modeling techniques.
- Research on climate data assimilation and initialization that improves predictability. This may include novel management and systems analysis of observational data and new methods for the analysis and handling of large data sets relevant for Earth System Models.
- Research on the predictability of the climate system at high spatial resolution and subseasonal to decadal scales. This may include multi-model ensemble methods and error propagation control.
- Studies of natural decadal variability in a changing climate and human drivers of decadal climate change. This may

include, for example: the roles of clouds, aerosols, black soot, methane, and ozone; ice-sheet dynamics; climatic effects of natural hazards; regional aspects of the water and carbon/nitrogen cycles; surface vegetation impacts on human and animal activities; decadal solar variability; variability in ocean and atmospheric patterns; and socioeconomic feedbacks.

- Research to enable upscaling local information for regional and global modeling, and downscaling model predictions for regional and local applications. This may include new approaches for upscaling land surface features, glaciers, and human systems, as well as incorporating specific human systems data into downscaling of models.
- Development of metrics and procedures for testing and evaluating climate and climate impacts predictions. This may include: methods to visualize uncertainties and biases in results; analysis of paleoclimate and anthropogenic records to improve estimates; and quantification of uncertainties.
- Research that examines the effects of human behavior and adaptation to climate variability and change on future climate and natural environments. This may include linking physical conditions and societal activities at the appropriately relevant regional scales.

USDA-NIFA Areas of Interest:

Climate change has the potential to irreversibly alter agricultural ecosystems, such as agricultural lands, forests and rangelands that are essential for the production of agricultural goods and provision of ecosystem services. Agricultural modeling needs related to climate change arise from the necessity to project crop, livestock, forestry, range, and aquaculture yields at multiple scales. Increasing air temperature, wide swings of air temperature over short periods of time (e.g., warm conditions followed by a hard frost early during the growing season), increased precipitation or drought in different areas, changing intensity and timing of precipitation, increasing length of growing season, conditions accelerating crop maturation, and severe weather all are likely to affect agricultural production positively or negatively, and in different parts of the country. In addition to climate and precipitation downscaling to the farm and ranch scale, further temporal downscaling to sub-daily time intervals is needed for precipitation intensities to drive hydrology, erosion, and water quality process-based models where infiltration excess runoff generation mechanisms are dominant.

USDA seeks research projects that clearly demonstrate the linkages between research and the broader program goals outlined in the synopsis. Within these broader goals, USDA aims to support projects that focus on the creation of climate models that are 1) integrated with or can later be coupled to models on agricultural production or natural resource management; or 2) that can be used to describe and predict thresholds or trends in resilience of agricultural lands, forests or rangelands that affect their ability for food, feed, fiber and fuel production or provide ecosystem services such as carbon sequestration under altered seasonal or extreme climate-driven conditions. Approaches include but are not limited to:

- Scenario-based analysis of the climatological, environmental, resource, technological, and economic implications of different climate impacts on agroecosystem functions.
- Spatially explicit climate-ecosystem models at regional to global scales, to improve our understanding of contemporary and historical changes in agroecosystem structure and functioning, and synthesis of known effects of increasing CO₂, warming, changes in precipitation, extreme events, and other factors.

Developing the next comprehensive climate model is a major challenge requiring engagement by researchers from many disciplines. The next generation climate model will need to be high resolution, enabling predictions in the decadal timeframe and at regional scales. It will need to incorporate and advance sophisticated understanding of natural and human-moderated systems; not only their physical aspects, but also biological and human, including contributions from the built environment. USDA will support research to develop climate models that can be linked to crop, forestry, aquaculture, and livestock models to assess risks and potential outcomes of possible risk management strategies so that development and yields can be projected reliably at different spatial and temporal scales. These types of models include but are not limited to:

- Models yielding data on temperature, water, atmospheric composition and sunlight that can be scaled from large regions of the country to regional scales that drive models for accurate crop development, yield projections, and development of diseases, pest outbreaks, and weeds.
- Weather event models that downscale regional climate change forecasts into daily weather for crop and environmental model simulations at the farm scale.
- Coupled climate and hydrologic models to help manage water allocations from snowmelt, reservoirs, etc., to deal with competing demands from agricultural, energy, environmental, urban/industrial, and western land management uses.
- Earth system models that can estimate the impacts of changing land use and changing land management practices on water, soil and air resources given changing climate, with enough specificity to identify and account for environmentally sensitive "hot spots" on the landscape that may have greater influence on water, soil and air quality.
- Climate models incorporating social and economic factors affecting food, fiber, and biofuel feedstock that can address the impact of climate change on commodity production and delivery.
- Coupled climate, agronomic, water quality, resource conservation and economic impact models suitable for the development and assessment of planning and management strategies that exploit opportunities and mitigate adverse impacts of anticipated, yet uncertain, climate change scenarios.

Projects are encouraged to be trans-disciplinary incorporating biological, economic, and social sciences to address the interconnectivity of agricultural practices and environmental and social impacts and responses. This includes mechanisms to coordinate and support regional land use changes to reduce greenhouse gas emissions, stabilize agricultural productivity, and marketing of ecosystem services to economically enhance producers. An Earth system science approach that incorporates the natural, mathematical, engineering and social sciences is an integral part of modeling to understand the impacts of climate change on agroecosystems and the human interventions for adapting to and mitigating these impacts.

DOE-SC Areas of Interest:

Simulation of global and large-scale features of climate change has improved considerably over the past decade. Nevertheless climate and earth system models do not yet accurately simulate major modes of decadal/multidecadal climate variability, e.g., the Pacific Decadal Variability (PDV) and Atlantic Multidecadal Oscillation (AMO). An additional area of substantial model uncertainty remains in model treatment of aerosols. As part of this NSF-USDA-DOE joint solicitation DOE-SC plans to strengthen 1) its FOA 10-0000242 Modes of Low Frequency Variability in a Changing Climate (<http://www.sc.doe.gov/grants/FOA-10-0000242.html>) by focusing in the present call on Decadal Modes of Variability; and 2) its FOA 10-04 Climate Uncertainties at Regional and Global Scales (http://www.sc.doe.gov/grants/LAB10_04.html) by focusing on the Indirect Effect of Aerosols.

Focus on Decadal Modes of Climate Variability

- Interaction of Climate Change and Decadal Modes of Natural Climate Variability:

Decadal/multidecadal modes of climate variability often mask the signals of climate change, making the detection and attribution of climate change challenging. Activities that focus on the identification, evaluation, and understanding of low frequency modes, (e.g., PDV, and AMO) and how these may change in a changing climate, as evidenced in coupled model simulations, are encouraged under this call. Use of multi-model ensembles is encouraged as are sensitivity studies involving state-of-the-science coupled climate and earth system models and/or regional climate models.

- Simulation of Climate Extremes under a Changing Climate:

Extreme events have large societal impacts. Applications that focus on understanding and simulating processes that influence the statistics of extreme events (e.g., modulation of statistics due to the phase of natural modes of variability) are solicited. The use of multi-model ensembles and/or innovative use of existing mathematical and statistical tools to analyze extreme event statistics is encouraged. The aim of this research is to better quantify the frequency, duration, and intensity of extreme events under climate change and elucidate the role of decadal/multidecadal modes climate variability in modulating extremes.

Focus on the Indirect Effect of Aerosols

- The "indirect effect" of aerosols on climate relates to the changes in net radiation in the atmosphere due to its effect on cloud properties through changes in cloud albedo and precipitation processes. These complex processes have large uncertainties in magnitude and sign. As part of this solicitation, applications that examine the decadal contributions of the indirect effect of aerosols in coupled global models are sought. The quantification of uncertainties of these indirect effects in warm, mixed-phase, and cirrus clouds is encouraged, as are intercomparisons of various existing schemes at regional and global scales. Studies that may elucidate how indirect effects may change in future climate scenarios are also encouraged. It is to be noted that model development is not a priority of this call. However, the incorporation of off-the-shelf schemes towards the understanding and quantification of the indirect effect of aerosols is encouraged as part of this solicitation. Computationally efficient schemes are especially encouraged.

III. AWARD INFORMATION

The duration of awards is expected to be 2 to 3 years for Type 1 (capacity/community building) proposals and from 3 to 5 years for Type 2 (full research project) proposals. Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

This is an interagency partnership between NSF, USDA, and DOE, therefore meritorious proposals may be funded by one or more agencies at the option of the agencies, not the proposer. For proposals selected for funding entirely by USDA or DOE-SC, PIs will be asked to withdraw their proposal from NSF and resubmit it to USDA-NIFA or DOE-SC in accordance with instructions given by the cognizant USDA-NIFA or DOE Program Officer. Subsequent grant administration procedures will be in accordance with the individual policies of the awarding agency.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs): Contact the appropriate program before preparing a proposal for submission.
- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

PI Limit:

PIs from NSF-funded FFRDCs may submit proposals to this competition. Projects involving USDA or DOE FFRDCs or National Laboratories will only be considered for co-funding by NSF if they are collaborative efforts that include non-federally funded institutions. To facilitate possible interagency funding of such collaboratives, an institution other than the USDA or DOE FFRDC must serve as the lead institution. This is necessitated solely by NSF rules for funding collaborative grants and should not be construed as a comment on capability or leadership. Proposals for FFRDCs must obey NSF budget guidelines and may not include costs already covered by federal funds.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

An individual may appear as Principal Investigator (PI), co-PI, or other senior personnel on **only one Type 2 proposal** in response to this solicitation (the submission limit does not apply to Type 1 proposals). This limitation includes proposals submitted by a lead organization, any sub-award submitted as part of a proposal, or any collaborative proposal. If an individual is listed as PI, co-PI, or senior personnel on more than one proposal, all of

those proposals will be returned without review.

Additional Eligibility Info:

Projects involving USDA-NIFA or DOE FFRDCs will only be considered for co-funding by NSF if they are collaborative efforts that involve non-federally funded institutions. Proposals for FFRDCs must obey NSF budget guidelines and may not include costs already covered by federal funds. To facilitate possible interagency funding of such collaboratives, an institution other than the USDA-NIFA or DOE-SC facility must serve as the lead institution.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent (required):

Please note: All materials should be submitted to NSF. NSF will share all submitted materials with USDA-NIFA and DOE-SC throughout the review process.

One-page Letters of Intent are required for the Spring 2010 competition. They will only be used for planning and will not be used to make decisions about project quality or appropriateness.

Only proposals with a corresponding valid Letter of Intent will be considered. Letters of Intent should specify: (1) Project title, with the first words identifying the proposal as Type 1 or Type 2; (2) identification of the provisional project team and their institutional affiliations; and (3) brief description of the specific goals of the proposal (maximum of 300 words). Proposers should make sure to click the "Submit" button on FastLane once their Letter of Intent is entered into the system to ensure it is formally submitted to NSF.

To be considered valid, each Letter of Intent must be associated with a keyword file created by and submitted from the keyword utility on the solicitation's companion website (<http://www.nsf.gov/crssprgm/climate/>). Keyword files will be used to plan the merit review and will not be used to evaluate project quality or appropriateness.

Letters of intent arriving after the close of the Letter of Intent submission deadline or that lack the specified keyword file will be returned and any proposals associated with those letters of intent will be returned without review.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- Sponsored Projects Office (SPO) Submission is not required when submitting Letters of Intent
- A Minimum of 0 and Maximum of 4 Other Senior Project Personnel are allowed
- A Minimum of 0 and Maximum of 10 Other Participating Organizations are allowed
- Submission of multiple Letters of Intent is allowed

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

Please note: All materials should be submitted to NSF. NSF will share all submitted materials with USDA-NIFA and DOE throughout the review process.

In addition to criteria specified in the NSF Grant Proposal Guide or NSF Grants.gov Application Guide, additional submission materials will be required for both Type 1 and Type 2 proposals. Proposals failing to include these additional materials will be returned without review. Please refer to the below list when submitting proposals to ensure compliance.

- **Cover Sheet:**
 - **Required Letter of Intent Number:** For a proposal to be valid, the cover page of the proposal must include the corresponding number assigned to the associated Letter of Intent.
 - **Proposals Involving USDA or DOE National Laboratories:** For NSF to consider co-funding proposals that are

collaborative efforts that involve USDA and DOE National Laboratories must be submitted with an institution other than the USDA or DOE Laboratory as the lead institution.

- **Title:**
 - The title of each proposal must start with either "Type 1" or "Type 2" to identify the type of proposal. Please refer to Section II, Program Description of the solicitation for proposal type definitions.
- **Project Description:**
 - Type 1 and type 2 proposals will be allotted 15 pages for the Project Description. Detailed project and data management plans should be included as supplementary documents as indicated under the Supplementary Document heading below.
- **Budget:**
 - All proposals should include travel costs for the annual PI meeting. These meetings will be conducted in Washington, D.C. and last, on average, three days.
 - Proposals that require special facilities normally covered by NSF for unsolicited proposals, such as fee-for-use computer time or other similar needs, must explicitly include the cost of the facility (or estimated cost) in the budget. These costs should appear in the "Other" category and be explained in the budget justification. A financial estimate and letter of commitment from the facility operator must be included in the supplementary documents appended to the end of the proposal. When calculating the final budget total, please take into account information on Indirect Cost Limitations noted in the solicitation.
- **Supplementary Documents:**
 - **Project Management Plan:** For Type 2 proposals only, each proposal must include a detailed project management plan of no more than three pages. It should include a timeline for the project and its activities, project milestones, a list of deliverables, and a communication strategy between the involved parties.
 - **Data Management Plan:** All proposals must include a data management plan of not more than two pages that conforms to the NSF Data Policy. Data related to this solicitation may take many forms including observational, theoretical, and model-generated output. For those projects where no data will be generated, a statement must be made to that effect. A copy of the NSF Data Policy is posted on the solicitation's companion website (<http://www.nsf.gov/crssprgm/climate/>).
 - **Postdoctoral Mentoring Plan:** Proposals that request funding to support postdoctoral researchers must include a mentoring plan that is no more than one page. This plan should consist of activities and opportunities tailored specifically to the personal professional development of the post-doc(s) involved.
- **Electronic Documents:** No later than 24 hours after the stated proposal deadline, each lead PI must submit two electronic documents: a keyword file and a concatenated list of conflicts of interest for all participants involved in the project. Instructions, templates, and utilities to help create and submit these files can be found on this solicitation's companion website (<http://www.nsf.gov/crssprgm/climate/>). Note that for collaborative proposals, only the lead PI for the collaborative will submit these documents.
 - **Keyword File:** This file consists of three words, selected from the list provided on the solicitation's companion website, that most closely describe the project topic. Proposers submitting the keyword file should be sure to click the "Submit" button after keywords have been selected. This will send the keywords in an automatic email to NSF. Keywords are for merit review planning purposes only and will not be used to evaluate project worthiness.
 - **Conflicts of Interest Spreadsheet:** This spreadsheet contains a list of all project participants, their institutional affiliations, and a list of all of the people conflicted with each participant. The list also contains information on the nature of the conflict as well as the institutional affiliation, if known, of the person in conflict. This list will be used by NSF to determine project conflicts of interest and must be generated according to instructions on the solicitation's companion website.

B. Budgetary Information

Cost Sharing: Cost sharing is not required under this solicitation.

Indirect Cost (F&A) Limitations:

Institutional overhead cannot be charged on costs for facilities normally covered by NSF and/or DOE-SC for unsolicited proposals. These include but are not limited to fee for use computing and other similar shared-use facility expenses. Questions regarding costs and use of these or other NSF or DOE-SC shared-use facilities should be directed to one of the NSF or DOE-SC program directors named in the solicitation.

For awards made by USDA-NIFA, Section 1462(a) of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. 3310(a)) limits the recovery of indirect costs to 22 percent of total federal funds awarded. Revised budgets will be solicited if these guidelines are not met by an application to be awarded by USDA-NIFA.

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. proposer's local time):
May 24, 2010
- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):
June 25, 2010

D. FastLane/Grants.gov Requirements

For Proposals Submitted Via FastLane:

Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must

electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: <https://www.fastlane.nsf.gov/fastlane.jsp>.

- **For Proposals Submitted Via Grants.gov:**

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: <http://www.grants.gov/CustomerSupport>. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program where they will be reviewed if they meet NSF proposal preparation requirements. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: <http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf>.

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities

Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

Additional Review Criteria:

All proposals will be reviewed as a group, with all agencies collaborating, i.e., there will not be separate agency-specific

review panels. In addition to the standard review criteria described above, the following additional criteria will be used in evaluating each proposal:

- o Each project will be reviewed for its responsiveness to the goals of the solicitation and the extent to which multiple disciplines are engaged in moving toward a systems-approach to regional and decadal modeling.
- o Proposals will also be evaluated on the extent to which they engage students at the undergraduate and graduate levels, postdoctoral researchers, and early career scientists from a diverse set of disciplines in team-oriented, cross-disciplinary activities focused on achieving the goals of the solicitation.
- o For Type 2 proposals, special attention will be given to: (1) the soundness of the project and data management plans and (2) the appropriateness of the budget for the work proposed.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (GC-1); * or Research Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the *NSF Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

- All NSF projects will be subject to the NSF Data Policy, a copy of which can be found on the solicitation's companion website (<http://www.nsf.gov/crssprgm/climate/>).
- For each award, one or more project representatives will be required to attend an annual PI meeting where they will report on project progress to other awardees, the funding agencies, and other interested parties, as well as to work to integrate their efforts with those of other awardees.
- Meritorious proposals that are deemed to be competitive may be funded by NSF, USDA-NIFA, and/or DOE-SC. No funds will be transferred between agencies. Therefore, for awards fully or partially funded by USDA-NIFA or DOE-SC, PIs will be asked to withdraw their proposal from NSF and resubmit it to USDA-NIFA or DOE-SC according to that agency's policies and procedures under the guidance of the cognizant USDA or DOE Program Officer listed in the solicitation.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

Additional Reporting Requirements Specific to the EaSM Solicitation

- For awards funded by NSF, PIs will be required to include descriptions of their project milestones and their data management activities in their annual reports. Data reporting should conform to current NSF data policy guidelines; PIs should consult with the managing program officer.
- Reporting requirements for awards funded by USDA-NIFA and DOE-SC will conform to those specified by the agency funding the proposal.
- For collaborative projects that are funded by NSF and either DOE-SC or USDA-NIFA, the annual report of the lead project in the collaborative that is resident at NSF must include a description of the activities and milestones of the parts of the project that are funded by the other agencies.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Jay Fein, GEO/AGS, telephone: (703) 292-8527, email: jfein@nsf.gov
- Eric C. Itsweire, Directorate for Geosciences (GEO), telephone: (703) 292-8582, email: eitsweir@nsf.gov
- Thomas F. Russell, Directorate for Mathematical & Physical Sciences (MPS), telephone: (703) 292-4863, email: trussell@nsf.gov
- Tanja Pietrass, Directorate for Mathematical & Physical Sciences (MPS), telephone: (703) 292-2170, email: tpietras@nsf.gov
- Robert Sanford, telephone: (703) 292-7120, email: rsanford@nsf.gov
- Elizabeth R. Blood, Directorate for Biological Sciences (BIO), telephone: (703) 292-8470, email: eblood@nsf.gov
- John Cozzens, Directorate for Computer & Information Science & Engineering (CISE), telephone: (703) 292-8910, email: jcozzens@nsf.gov
- Rita Teutonico, OAD/SBE, telephone: (703) 292-7118, email: rteutoni@nsf.gov
- Cheryl L. Eavey, Directorate for Social, Behavioral & Economic Sciences (SBE), telephone: (703) 292-7269, email: ceavey@nsf.gov
- Philip Bogden, Office of Cyberinfrastructure (OCI), telephone: (703) 292-7092, email: pbogden@nsf.gov
- Irene Qualters, telephone: (703) 292-2339, email: iqualter@nsf.gov
- Erica Key, Office of Polar Programs (OPP), telephone: (703) 292-8029, email: ekey@nsf.gov
- Peter Milne, OPP, telephone: (703) 292-4714, email: pmilne@nsf.gov
- Luis Tupas, US Department of Agriculture, National Institute of Food and Agriculture (USDA-NIFA), telephone: (202) 401-4926, email: ltupas@nifa.usda.gov
- Renu Joseph, Department of Energy, Office of Science (DOE-SC), Office of Biological and Environmental Research, telephone: (301) 903-9237, email: Renu.Joseph@science.doe.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, National Science Foundation Update is a free e-mail subscription service designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the [NSF web site](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at <http://www.grants.gov>.

Dedicated Website Containing Important Information for Applicants to this Solicitation

There is a dedicated website for this solicitation (<http://www.nsf.gov/crssprgm/climate/>). It contains utilities to help proposers create and submit the required keyword files and integrated conflicts of interest spreadsheet. The website also contains links to the NSF Data Policy, Frequently Asked Questions, and other important resources.

Investigators considering submitting to this solicitation are strongly encouraged to examine the information on the solicitation's companion website before preparing their proposals.

Investigators considering submitting Type 2 proposals in response to this solicitation are strongly encouraged to speak with one of the NSF program directors named in the solicitation prior to preparing a proposal. Similarly, for proposals that involve USDA or DOE Laboratories, investigators are strongly encouraged to speak with the USDA-NIFA or DOE program directors named in the solicitation prior to preparing their proposal.

About the National Institute of Food and Agriculture

The National Institute of Food and Agriculture (NIFA) is an agency within the U.S. Department of Agriculture (USDA), part of the executive branch of the Federal Government. Congress created NIFA through the Food, Conservation, and Energy Act of 2008. NIFA replaced the former Cooperative State Research, Education, and Extension Service (CSREES), which had been in existence since 1994. NIFA's unique mission is to advance knowledge for agriculture, the environment, human health and well-being, and communities by supporting research, education, and extension programs in the Land-Grant University System and other partner organizations. NIFA doesn't perform actual research, education, and extension but rather helps fund it at the state and local level and provides program leadership in these areas. Through grants offered by NIFA, the USDA enables researchers throughout the United States to solve problems critical to our farmers, consumers, and communities. NIFA is the USDA's major extramural research agency, funding individuals, institutions, and public, private, and non-profit organizations. NIFA's education programs supports and promotes teaching excellence, enhances academic quality, and develops tomorrow's scientific and professional workforce. In cooperation with public institutions, private sector partners, and the Land-Grant University System, NIFA provides national leadership to address critical educational issues. NIFA's extension projects deliver science-based knowledge and informal educational programs to people, enabling them to make practical decisions.

NIFA Web site:

<http://www.nifa.usda.gov/>
Phone: 202-720-4423

Street Address:

National Institute of Food and Agriculture
Waterfront Centre
800 9th St. SW., Washington, DC 20024

Mailing Address:

United States Department of Agriculture
National Institute of Food and Agriculture
1400 Independence Avenue SW., Stop 2201
Washington, DC 20250-2201

About the Department of Energy's Office of Science, Office of Biological and Environmental Research

The Department of Energy's Office of Science sponsors fundamental research programs in basic energy sciences, biological and environmental sciences, and computational science including vital parts of U.S. research in climate change, geophysics, genomics, life sciences, and science education. Within the Office of Science, the Office of Biological and Environmental Research (BER) supports world-class biological and environmental research programs and scientific user facilities to support DOE's energy, environment, and basic research missions. BER's activity in Regional and Global Climate Modeling activity sponsors projects that engage in analysis and process-based evaluation of multi-model climate change projections for the 21st century using innovative metrics. This is intended to lead to greater understanding of the uncertainties and shortcomings of dynamically coupled state-of-the-science regional and global climate models.

Regional and Global Climate Modeling Web site: <http://www.sc.doe.gov/ober/CESD/regional.html>

Dr. Renu R. Joseph
Office of Science, Office of Biological and Environmental Sciences Division
Climate and Environmental Sciences Division, SC-23.1
Department of Energy, GTN Bldg.
1000 Independence Ave, SW
Washington, DC 20585-1290
Phone: (301) 903-9237
Fax: (301) 903-8519
Email: renu.joseph@science.doe.gov

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <http://www.nsf.gov>

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**
 - Send an e-mail to: nsfpubs@nsf.gov
 - or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Division of Administrative Services
National Science Foundation
Arlington, VA 22230

X. APPENDIX

Answers to Frequently Asked Questions

1. *What is an Earth System Model?*

Earth System Models are a class of models that integrate components and processes beyond the physical, dynamical systems present in climate models, with the intention of accurately representing the complex human, natural, chemical, and physical interactions that contribute and respond to climate

2. *How are predictability and prediction defined within the context of this solicitation?*

Predictability- The extent to which future states of a system may be predicted based on knowledge of current and past states of the system. Since knowledge of the system's past and current states is generally imperfect, as are the models that utilize this knowledge to produce a prediction, predictability is inherently limited. Even with arbitrarily accurate models and observations, there may still be limits to the predictability of a physical system, e.g., chaotic systems.

Climate prediction- The prediction of various aspects of the climate of a region during some future period of time. Climate predictions are generally in the form of probabilities of anomalies of climate variables (e.g., temperature, precipitation). (The term "climate projection" rather than "climate prediction" is now commonly used for longer-range predictions that have a higher degree of uncertainty and a lesser degree of specificity. For example, this term is often used for "predictions" of climate change that depend on uncertain consequences of anthropogenic influences such as land use and the burning of fossil fuels.) (Adapted from : AMS Glossary of Meteorology, 2nd Ed, June 2000 <http://amsglossary.allenpress.com/glossary/browse?s=c&p=1>)

3. *What is meant by 'cyberinfrastructure'?*

Cyberinfrastructure tools may include shared hardware, software, observational archives and data networks, visual organizations, model/data visualization, provenance tracking, communications and conferencing capabilities. For more information please refer to NSF's Office of Cyberinfrastructure website: <http://www.nsf.gov/oci>

4. *Are investigators who are not Earth Scientists eligible to submit proposals?*

Yes. Advancements in Earth System Modeling will require the parallel, collaborative efforts of diverse teams from many disciplines. These interdisciplinary teams of experimental, theoretical, modeling and computational researchers could include, but are not limited to, biologists, chemists, computer scientists, geoscientists, materials scientists, mathematicians, physicists, cyberinfrastructure specialists, and social scientists. Since this is such an interdisciplinary effort, single PI proposals are strongly discouraged.

5. *How does this solicitation differ from Coupled Natural and Human Systems (CNH) or other NSF climate-related solicitations?*

This solicitation is complementary, but it places the focus on an integrated system modeling approach at regional scales for enhanced decadal predictions. Please refer to http://nsf.gov/funding/pgm_summ.jsp?pims_id=13681 for more details on the scope of Dynamics of Coupled Natural and Human Systems (CNH).

6. *Can investigators from national laboratories other than those associated with USDA and DOE submit proposals?*

No. See eligibility rules in the solicitation.

7. *Will proposals for field programs or large observational campaigns be supported by this solicitation?*

It is not the intention to support field programs or large observational campaigns. Some fundamental, innovative laboratory experiments may be considered, as long as the outcome can be shown to directly improve model representation of a process that is important to integrated Earth System Modeling. To determine the appropriateness of the proposed research activity, please email the most relevant program director listed on the solicitation webpage prior to submission.

8. *Is there an upper limit on the cost of a project submitted to this competition?*

The budget for Type 1 proposals should not exceed \$300,000 per year, and the budget for Type 2 proposals should not exceed \$1,000,000 per year. In addition, the budget should accurately reflect the effort of all parties, as detailed in the budget justification. Please also refer to the "Anticipated funding amount" and "Estimated number of awards" described earlier in the Summary of Program Requirements, Award Information section of the solicitation, as well as the descriptions of Type 1 and Type 2 proposals in the Program Description section.

9. *My project is large and complex; can I request additional space in the Project Description?*

No. All proposals must adhere to the 15-page limit.

10. *Do all proposals require a data and project management plan?*

All proposals require a data management plan; only Type 2 proposals require a project management plan. If you do not expect your project to produce any data, please state so in your data management plan. Please refer to Section V. of the solicitation, entitled Proposal Preparation and Submission Instructions.

11. *What is the purpose of the required annual meetings? Should I include travel monies for these meetings in the proposal budget?*

The annual meetings are venues for project scientists to share progress and results while interacting with fellow EaSM awardees. It is also encouraged for students, postdocs, and early career scientists working on EaSM projects to attend to foster exchanges that will build and enhance longevity of the EaSM community.

Yes. Travel funds for these meetings, which will be held in Washington, D.C., for a period of up to 3 days, should be included in the proposal budget.

12. *Can I volunteer to be on one of the review panels?*

Yes. Please contact one of the cognizant program officers for further details.

13. *What should I do if I still have questions?*

If you are uncertain if your proposal is appropriate for this program, please email the most relevant program officer listed on the solicitation web page.

14. *What do you mean by decadal prediction? Why are we focusing the domain of interest on the next couple of decades?*

Climate and earth system modeling simulations under various emission scenarios indicate that the planet is committed to an increase in global average surface temperature over the next couple of decades, and climate change projections beyond that time have large uncertainties depending on emission scenario and models. Based on this evidence, the motivation for the EaSM solicitation is best described in terms of answering questions such as, what's happening now and why (attribution) and what can we expect over the next 10-20 years and why? Reliable predictions over the next several decades are essential for, among other things, planning future infrastructure, ensuring adequate food production and water supplies, and providing sound, informed stewardship for ecological, agricultural and other human systems.

Research which explores multi-decadal natural (internal) variability is also welcome to this funding call. Internal variability on intra-decadal, multi-decadal and intra-centennial time scales can be a significant source of uncertainty on decadal time scales, especially on regional spatial scales.

In summary, if your proposed research includes future GHG forcing as a scenario dependent variable, it is not appropriate for this solicitation.

Please bear in mind that competitive projects must be conducted within the broad framework of adaptation. That is, how will the project link to climate system/Earth system modeling and prediction of climate change and its impacts on and feedbacks from ecological, agricultural, and other human systems over the next couple of decades.

The EaSM solicitations over this and the next 4 years will remain focused on the science of climate change and impacts, but will evolve as dictated by the state of the science and by societal needs.

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The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

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