

# Hydrologic Sciences

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## PROGRAM SOLICITATION

NSF 15-558

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### REPLACES DOCUMENT(S):

NSF 13-531

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National Science Foundation

Directorate for Geosciences  
Division of Earth Sciences

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

Proposals Accepted Anytime

Henceforth, investigators can submit proposals to the Program at any time. Proposals submitted to other program solicitations, such as CAREER or EAR Post-Doctoral Fellowships, should continue to meet their respective deadlines.

## IMPORTANT INFORMATION AND REVISION NOTES

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- Henceforth, any proposal submitted in response to this solicitation will be accepted at anytime.
- Institutional eligibility restrictions have been added.
- Facilities, Research Experiences, and Metadata sections added to proposal preparation section.
- Program synopsis, introduction, and program description were updated.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 16-1](#)), which is effective for proposals submitted, or due, on or after January 25, 2016.

## SUMMARY OF PROGRAM REQUIREMENTS

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### General Information

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**Program Title:**

Hydrologic Sciences (HS)

**Synopsis of Program:**

The Hydrologic Sciences Program focuses on the fluxes of water in the environment that constitute the water cycle as well as the mass and energy transport function of the water cycle. The Program supports the study of processes from rainfall to runoff to infiltration and streamflow; evaporation and transpiration; the flow of water in soils and aquifers; and the transport of suspended, dissolved, and colloidal components. The Hydrologic Sciences Program retains a strong focus on linking fluxes of water and the components carried by water across boundaries between various interacting facets of the terrestrial system and the mechanisms by which these fluxes co-organize over a variety of timescales and/or alter fundamentals of water cycle interactions within the terrestrial system. The Program is also interested in how water interacts with the landscape and the ecosystem as well as how the water cycle and its coupled processes are altered by land use and climate. Studies may address physical, chemical, and biological processes that are coupled directly to water transport. Projects submitted to Hydrologic Sciences commonly involve expertise from basic sciences, engineering and mathematics; and proposals may require joint review with related programs. The Hydrologic Sciences Program will also consider synthesis projects.

**Cognizant Program Officer(s):**

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Thomas Torgersen, telephone: (703) 292-8549, email: [ttorgers@nsf.gov](mailto:ttorgers@nsf.gov)
- Wendy Graham, Program Director, 785 N, telephone: (703) 292-7411, email: [wegraham@nsf.gov](mailto:wegramham@nsf.gov)
- Thomas Burbey, Program Director, 785 N, telephone: (703) 292-8549, email: [tburbey@nsf.gov](mailto:tburbey@nsf.gov)
- David Domanski, Science Assistant, 785 N, telephone: (703) 292-4733, email: [ddomansk@nsf.gov](mailto:ddomansk@nsf.gov)

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

- 47.050 --- Geosciences

## Award Information

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**Anticipated Type of Award:** Standard Grant or Continuing Grant

**Estimated Number of Awards:** 25 to 35

annually, pending availability of funds

**Anticipated Funding Amount:** \$10,000,000

annually, pending availability of funds.

Estimated program budget, number of awards, and average award size/duration are subject to the availability of funds and the quality of the proposals. Regular research awards supported by HS are generally, but not exclusively, in the range of \$250,000 to \$700,000 and of 2-4 years duration. Hydrologic process synthesis proposals should be at a level appropriate to the Project scope and are expected to be conducted at total levels of <\$1,000,000 over 3-5 years with an emphasis on support of graduate students and postdocs.

## Eligibility Information

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### Who May Submit Proposals:

Proposals may only be submitted by the following:

- 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.
- 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.

### Who May Serve as PI:

There are no restrictions or limits.

### Limit on Number of Proposals per Organization:

There are no restrictions or limits.

### Limit on Number of Proposals per PI or Co-PI:

According to the Division of Earth Sciences (EAR) policy [http://www.nsf.gov/geo/ear/resubmission\\_policy.jsp](http://www.nsf.gov/geo/ear/resubmission_policy.jsp), proposals that have been declined are not eligible for resubmission for one year from the original date of submission and must be substantially revised to be considered. Exceptions to this policy require prior approval by an EAR Program Officer.

## Proposal Preparation and Submission Instructions

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### A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **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](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](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide))

### B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:**

Not Applicable
- **Other Budgetary Limitations:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

### C. Due Dates

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

Proposals Accepted Anytime

Henceforth, investigators can submit proposals to the Program at any time. Proposals submitted to other program solicitations, such as CAREER or EAR Post-Doctoral Fellowships, should continue to meet their respective deadlines.

## Proposal Review Information Criteria

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### Merit Review Criteria:

National Science Board approved criteria apply.

## Award Administration Information

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### Award Conditions:

Standard NSF award conditions apply.

### Reporting Requirements:

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

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## I. INTRODUCTION

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The Hydrologic Sciences Program focuses on the fluxes of water in the environment that constitute the water cycle as well as the mass and energy transport function of the water cycle. The Program supports the study of processes from rainfall to runoff to infiltration and streamflow; evaporation and transpiration; the flow of water in soils and aquifers; and the transport of suspended, dissolved and colloidal components. Topics may be investigated as deterministic or stochastic processes by observational, experimental or modeling approaches.

## II. PROGRAM DESCRIPTION

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Proposals submitted to the Hydrologic Sciences Program should advance knowledge and research methodologies with regard to hydrologic processes and functions. The Program is interested in research that: (1) fills identified knowledge gaps in hydrology, and (2) poses fundamental new questions about the role and function of water in the critical zone system and (3) will provide answers to those fundamental questions. Consequently, Hydrologic Sciences is not interested in case studies that apply current knowledge to site-specific problems, as they will have only limited transferable value. The Program acknowledges that the study of specific hydrologic questions requires a site and that the results may have direct applications. Such applications are usually considered a positive aspect under Broader Impact and not Intellectual Merit.

The Hydrologic Sciences Program supports studies examining (1) the spatial and temporal heterogeneity of water and water-borne chemical fluxes and storages from local to global scales, (2) interfacial water fluxes and pathways among system compartments; and (3) how hydrologic processes couple to the critical zone via land-use change, climate variability and ecosystem function. Hydrologic Sciences also supports research in aqueous, colloidal and suspended geochemistry that is directly connected to hydrologic transport processes. Because the study of hydrologic processes may also require expertise from other basic sciences, engineering and mathematics, the program encourages interdisciplinary proposals and conducts joint review with related programs. The Hydrologic Sciences Program will also consider synthesis projects.

The Hydrological Sciences Program retains strong emphasis on linking the fluxes of water and the components carried by water across boundaries between interacting facets of the terrestrial system and the mechanisms by which these fluxes co-organize over a variety of timescales and/or alter the fundamentals of the terrestrial interactions. The Program is also interested in how water interacts with the landscape and the ecosystem as well as how the water cycle and its coupled processes are altered by land use and climate. Studies may address physical, chemical, and biological processes that are coupled directly to water transport. The Hydrologic Sciences Program is interested in scaling analysis, systems analysis, hydrologic systems modeling studies (on all scales); and observational, experimental, theoretical, modeling or field studies that elucidate sensitivity, feedback loops and thresholds of terrestrial systems coupled through the flow and transport mediated by the water cycle.

Projects are expected to be at a fundamental level and should also be smaller (see budget guidance) in scope than is supported by larger multi-Directorate solicitations. Interdisciplinary teams considering submission of proposals are encouraged to contact the cognizant Program Officer and to communicate their anticipated scope before proceeding with proposal development. While field, laboratory, and computational hydrology remain the core focus of Hydrologic Sciences, the Program will also consider synthesis projects that hold promise for significantly advancing hydrologic science and the understanding of hydrologic couplings of the critical zone environment. Synthesis activities should be at a level appropriate to the scope and funding of the program.

Principal Investigators of Hydrologic Sciences awards are required to submit metadata files for all data sets and derived data products. Proof of the metadata entry (active hyperlinks) must be included in the Final Project Report to NSF in the section entitled: Publications - Internet Dissemination. Principal investigators are strongly encouraged to utilize the CUAHSI HIS facilities (<https://www.cuahsi.org/instructions-for-nsf-principal-investigators>) that considers several options and several types of data.

This context for the Hydrologic Sciences Program is based on the National Academy of Sciences (2012) report entitled "Challenges and Opportunities in the Hydrologic Sciences" as well as many other documents including "Basic Research Opportunities in Earth Science" (NAS, 2001); "New Research Opportunities in the Earth Sciences" (2012) and "Geovision Report" (NSF, 2009). These documents identify multiple questions whose answers are central to the understanding of the temporal and spatial variability of the water cycle across Earth's terrestrial landscapes and thus to the Hydrologic Sciences program.

- National Research Council, 2001, Basic Research Opportunities in the Earth Sciences, National Academy Press, Washington, D.C., 154 pp.
- NSF Advisory Committee for Geosciences, 2009, Geo Vision: Unraveling Earth's complexities through the Geosciences, Washington, D.C., 44 pp
- National Research Council, 2012, New Research Opportunities in the Earth Sciences, National Academy Press, Washington, D.C., 118 pp.
- National Research Council, 2012, Challenges and Opportunities in the Hydrologic Sciences, National Academy Press, Washington, D.C., 162 pp.

Projects currently supported by the program can be found by using the NSF Award Search (Program Information) engine and entering Element Code 1579.

### III. AWARD INFORMATION

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**Anticipated Type of Award:** Standard Grant or Continuing Grant or Cooperative Agreement

**Estimated Number of Awards:** 25 to 35 annually

**Anticipated Funding Amount:** \$10,000,000 annually, pending availability of funds.

Estimated program budget, number of awards, and average award size/duration are subject to the availability of funds and the quality of the proposals. Regular research awards supported by HS are generally, but not exclusively, in the range of \$250,000 to \$700,000 and of 2-4 years duration. Hydrologic process synthesis proposals should be at a level appropriate to the Project scope and are expected to be conducted at total levels of <\$1,000,000 over 3-5 years with an emphasis on support of graduate students and postdocs.

### IV. ELIGIBILITY INFORMATION

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#### Who May Submit Proposals:

Proposals may only be submitted by the following:

- 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.
- 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.

#### Who May Serve as PI:

There are no restrictions or limits.

#### Limit on Number of Proposals per Organization:

There are no restrictions or limits.

#### Limit on Number of Proposals per PI or Co-PI:

According to the Division of Earth Sciences (EAR) policy [http://www.nsf.gov/geo/ear/resubmission\\_policy.jsp](http://www.nsf.gov/geo/ear/resubmission_policy.jsp), proposals that have been declined are not eligible for resubmission for one year from the original date of submission and must be substantially revised to be considered. Exceptions to this policy require prior approval by an EAR Program Officer.

## V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

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### A. Proposal Preparation Instructions

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**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](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](mailto: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](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](mailto: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.5 of the Grant Proposal Guide provides additional information on collaborative proposals.

See Chapter II.C.2 of the [GPG](#) for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions.

**The following instructions supplement the Grant Proposal Guide and the NSF Grants.gov Application Guide:**

**EAR Data Policy:** Principal investigators are required to adhere to the EAR Data Policy available on the NSF website ([http://www.nsf.gov/geo/ear/2010EAR\\_data\\_policy\\_9\\_28\\_10.pdf](http://www.nsf.gov/geo/ear/2010EAR_data_policy_9_28_10.pdf)). Proposals should include a statement describing how the data policy requirements will be met.

Wherever possible, data should be lodged with established data centers utilizing the most appropriate formats and ontologies. For many hydrologic sciences projects, this can be accomplished within CUAHSI-HIS, EarthChem, and DataOne. However, it is acknowledged that not all data can be accommodated by these protocols. When data are not directly deposited with established catalogues, data should be registered with such catalogs to ensure the highest probability for discover via various searches. Final reports for all awards should include a statement describing how the data policy requirements have been met.

**Projects involving work in foreign countries:** Projects involving work in foreign countries: For studies in countries other than the United States, the project description should discuss, where appropriate, collaborations with scientists and students from the host country, and how these individuals will be involved in the project. Collaborations should be well justified, in that they represent true intellectual collaboration and utilize the expertise and specialized skills, facilities, and/or resources of the foreign collaborator. Letters of collaboration must be included in the Special Information and Supplementary Documents section of the proposal. These letters should include a discussion of the role of the collaborator in the project and the resources the collaborating foreign institution/organization will provide to the project. Principal investigators are encouraged to provide U.S. students and junior researchers with international research experiences. An important provision of [Grant Proposal Guide](#) (Sec II.C.2.j) states "some governments require nonresidents to obtain official approval to carry out investigations within their borders and coastal waters under their jurisdiction. PIs are responsible for obtaining the required authorizations and for advising NSF that they have been obtained or requested." Failure to obtain the appropriate permits for all aspects of the research effort may jeopardize not only the proposed research, but also the well-being of the personnel. Where relevant, arrangements to allocate samples and data between host country organization(s) or institution(s) and U.S. organization(s) or institution(s) should be discussed in the proposal. Investigators are encouraged to include any such permits (including legally required collecting, import, and export permits for samples, instrumentation, and data), authorizations, and agreements, in the Special Information and Supplementary Documents section of the proposal.

**Facilities:** For proposals that require support from the GAGE and/or SAGE facilities, investigators must obtain letters of support from UNAVCO and/or IRIS and include those letters as a Supplementary Document. Proposals that require NCALM support should include a subaward request to cover costs of LiDAR acquisition by NCALM.

**Research Experiences:** Projects anticipating the inclusion of REU, RET, or ROA activities should include those as part of the research proposal. Supplemental funding is intended only for unanticipated opportunities that arise during the course of the project.

## B. Budgetary Information

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### Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

### Other Budgetary Limitations:

Equipment needs that can be demonstrably linked to the conduct of a specific research project being proposed to EAR may be included within the budget of the related research proposal. In general, equipment requests on proposals submitted to EAR research programs should not exceed a total of \$50,000. Equipment requests in excess of \$50,000 usually require a separate proposal directly to the Instrumentation and Facilities Program. However, equipment requests of less than \$50,000 that are unassociated with specific research proposals may be submitted to the Instrumentation and Facilities Program. Investigators planning on submitting an EAR research proposal with a significant equipment budget are encouraged to discuss these plans with the relevant research program officer prior to submission.

## C. Due Dates

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

Proposals Accepted Anytime

Henceforth, investigators can submit proposals to the Program at any time. Proposals submitted to other program solicitations, such as CAREER or EAR Post-Doctoral Fellowships, should continue to meet their respective deadlines.

## D. FastLane/Grants.gov Requirements

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### For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions 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](mailto: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.

### 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. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: <http://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical 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](mailto: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.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

## VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. 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 either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with 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. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the [GPG](#) as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: [http://www.nsf.gov/bfa/dias/policy/merit\\_review/](http://www.nsf.gov/bfa/dias/policy/merit_review/).

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in [Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018](#). These strategies are integrated in



the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which 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.

## A. Merit Review Principles and Criteria

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The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

### 1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

### 2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (GPG Chapter II.C.2.d.i. contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i., prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
  - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
  - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and

mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

## B. Review and Selection Process

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Proposals submitted in response to this program solicitation will be reviewed by

Ad hoc Review and/or Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. 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 strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

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. After an administrative review has occurred, Grants and Agreements Officers perform 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.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, 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.

## VII. AWARD ADMINISTRATION INFORMATION

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### A. Notification of the Award

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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

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An NSF award consists of: (1) the award notice, 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 notice; (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 notice. 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](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](mailto: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](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag).

### C. Reporting Requirements

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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 no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following 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 all identified PIs and co-PIs on a given award. 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 Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also 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.

More comprehensive information on NSF Reporting Requirements 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](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag).

**EAR Data Policy:** Principal investigators are required to adhere to the [EAR Data Policy](#) available on the NSF website. Final reports for all awards should include a statement describing how the data policy requirements have been met.

Wherever possible, data should be lodged with established data centers utilizing the most appropriate formats and ontologies. For many hydrologic sciences projects, this can be accomplished within CUAHSI-HIS, EarthChem, and DataOne. However, it is acknowledged that not all data can be accommodated by these protocols. When data are not directly deposited with established catalogues, data should be registered with such catalogs to ensure the highest probability for discover via various searches. Final reports for all awards should include a statement describing how the EAR data policy requirements have been met.

**Metadata:** Principal Investigators of Hydrologic Sciences awards are required to submit metadata files for all data sets and derived data products. Proof of the metadata entry (active hyperlinks) must be included in the Final Project Report to NSF in the section entitled: Publications - Internet Dissemination. Principal investigators are strongly encouraged to utilize the CUAHSI HIS <https://www.cuahsi.org/instructions-for-nsf-principal-investigators> that considers several options and several types of data.

## VIII. AGENCY CONTACTS

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*Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.*

General inquiries regarding this program should be made to:

- Thomas Torgersen, telephone: (703) 292-8549, email: [ttorgers@nsf.gov](mailto:ttorgers@nsf.gov)
- Wendy Graham, Program Director, 785 N, telephone: (703) 292-7411, email: [wegraham@nsf.gov](mailto:wegram@nsf.gov)
- Thomas Burbey, Program Director, 785 N, telephone: (703) 292-8549, email: [tburbey@nsf.gov](mailto:tburbey@nsf.gov)
- David Domanski, Science Assistant, 785 N, telephone: (703) 292-4733, email: [ddomansk@nsf.gov](mailto:ddomansk@nsf.gov)

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: [fastlane@nsf.gov](mailto: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](mailto:support@grants.gov).

## IX. OTHER INFORMATION

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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, "NSF Update" is an information-delivery system 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 [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

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

In addition to the other programs in the Surface Earth Processes Section, closely related programs include:

- Climate Dynamics
- Physical and Dynamic Meteorology
- Chemical Oceanography
- Earth Sciences: Instrumentation and Facilities
- Faculty Early Career Development (CAREER) Program
- Geography and Regional Science
- Environmental Engineering
- Ecosystem Studies

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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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 55,000 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 Arctic 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](mailto:nsfpubs@nsf.gov)
  - or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

## PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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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  
Office of the General Counsel  
National Science Foundation  
Arlington, VA 22230



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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