



**U.S. NATIONAL SCIENCE FOUNDATION
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ALEXANDRIA, VIRGINIA 22314**

NSF 24-021

Dear Colleague Letter: Request for Information on Technologies to Enable Observations in Remote-Extreme Environments

November 21, 2023

Dear Colleagues:

OVERVIEW

With this Dear Colleague Letter (DCL), "Request for Information (RFI) on Technologies to Enable Observations in Remote-Extreme Environments," the National Science Foundation (NSF) Directorate for Geosciences (GEO) seeks broad input to answer the question, "What new technologies would allow transformative advances in accessing data and observations from remote-extreme environments (e.g., polar regions, under the sea and seafloor, deep within the Earth's crust, in the air, etc.)?"

This Dear Colleague Letter (DCL) does not invite research proposals nor is it a funding opportunity. However, the collective submission of input to this RFI spanning different perspectives from multiple constituent communities may be used to inform, refine, and catalyze future NSF investments and programs.

BACKGROUND

GEO supports fundamental research that advances the frontiers of knowledge and drives technological innovation while improving our understanding of the many processes that create and sustain vital natural environments and resources on which society depends. GEO is home to NSF's atmospheric and geospace, Earth, ocean, and polar research activities. In geoscience, observations are critical to advancing the frontiers of knowledge. Collecting these observations requires a broad range of infrastructure and tools.

OBJECTIVE

The goal of this DCL is to solicit ideas from the research community regarding what innovative technologies and solutions are needed to advance geoscience research and

knowledge in remote-extreme environments. Technological advances should enable real-time and reliable sensing, communications, localization, navigation, and mapping of Earth, ocean, geospace, and atmospheric environments for scientific research in an environmentally responsible manner. Data science and Artificial Intelligence (AI)/Machine Learning (ML) are also key components to be considered in connecting observations facilitated by new technology with the diverse information needs of researchers and data users (e.g., policy makers, resource managers, and other interested parties).

WHAT NSF IS LOOKING FOR?

NSF seeks to invest in approaches that will advance the ability to conduct observations in remote-extreme environments. This may be accomplished by identifying and addressing technological barriers currently faced by the geoscience and technology community as applied to characterization of the Earth, ocean, geospace, and atmosphere. Examples of barriers may include those related but not limited to power, communications, materials, data storage, miniaturization, long-term autonomous deployment, and community-/capacity-building. In this context, GEO is seeking community input to develop a full range of topical ideas/needs which may be further refined and used to inform future funding opportunities, workshops, novel collaborations, partnerships, and ultimately drive innovative solutions.

HOW TO RESPOND TO THIS RFI

NSF invites individuals, groups, and organizations to provide their input through an online submission form at <https://www.surveymonkey.com/r/GNLHW6V>. NSF recommends that all responses be written in a separate document, using the information provided below, and then pasted into the response fields on the form. The submission form requires the following information:

- Contact person full name.
- Affiliation.
- Title/Position within organization.
- Contact e-mail address.
- Additional author name(s) and affiliation(s).
- Expertise of the authors as relevant to this RFI.

Responses to the following questions will help inform GEO Program Officers on potential opportunities to advance the ability to conduct global observations in remote-extreme environments. Respondents need only provide feedback to the questions in the survey of greatest interest to them. Although responses are not limited by page/word count, concise responses and/or bulleted lists sufficient to convey key concepts would be most helpful. Additionally, NSF anticipates making the information in the submissions publicly accessible. Please indicate your willingness to have your responses made public by answering that

question on the survey.

- What observations in remote-extreme environments are required to move the science forward that are not able to be conducted now due to technological limitations?
- What is holding the research community back in terms of technology from providing observations that geoscientists really need to make transformative advances?
- Why are observations in remote-extreme environments an important priority? You may reference your own motivation, community papers, etc.
- What kind of capacity building and/or collaborative partner expertise is needed to advance observations in remote-extreme environments? What do you see as the next steps that could move the observational capabilities forward?
- Why is NOW the time to focus on observations in remote-extreme environments?
- How could new technologies reduce the environmental impact of observational research?
- How could new technologies help NSF achieve its objective to "Create Opportunities Everywhere?"

TIMELINE

Responses to this DCL must be received on or before 5:00 p.m. respondent's local time on January 8, 2024.

WHAT WILL NSF DO WITH THIS INFORMATION?

GEO will use this information to develop a full range of topical ideas/needs which may be further refined and used in the process of determining future funding opportunities, workshops, collaborations, development programs, partnerships, Program investment, and/or solicitations. This process may include, for example, engaging with RFI authors and other participants through brainstorming workshops or discussions focused on specific themes.

For questions concerning this RFI and submission of input, please contact any of the NSF Program Directors listed below:

- Kandace Binkley GEO/OCE (kbinkley@nsf.gov)
- Nicholas Anderson GEO/AGS (nanderso@nsf.gov)
- Candace Major GEO/EAR (cmajor@nsf.gov)
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Sincerely,

Alexandra R. Isern
Assistant Director

Directorate for Geosciences