NATIONAL SCIENCE FOUNDATION
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NSF 21-022

Dear Colleague Letter: Research Coordination and Planning Opportunities for the Directorate for Geosciences (GEO) in Artificial Intelligence (AI)

November 19, 2020

Dear Colleagues:

The National Science Foundation's (NSF) Directorate for Geosciences (GEO) encourages the submission of proposals for workshops, Research Coordination Networks (RCN), and other planning activities, including Early-concept Grants for Exploratory Research (EAGER) proposals, in Geosciences-themed research in Artificial Intelligence (AI). (Workshops associated with this DCL are identified as Conference proposals in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) and will hereafter be referred to as conferences.) Recent ground-breaking advances in AI have been enabled by increased computing power, algorithmic improvements in machine-learning, and the availability of large data sets. Synergies between research frontiers in AI and the Geosciences have the potential to stimulate further transformative progress in both fields.

GEO is committed to developing a portfolio of GEO-themed AI activities. To better allow the Geosciences research community to prepare for future AI-themed investments, GEO envisions funding a cohort of geoscientists and computer scientists to form and coordinate teams to address forefront and grand challenge research topics in geo-themed AI. Specifically, through this DCL, GEO encourages proposal submissions for conferences and RCNs that address challenges in the Geosciences that also include and leverage research in AI. Conference and RCN proposals in response to this DCL should aim to develop collaborations between AI and the geosciences and within one or more geosciences domains. The goals should include advancing AI and contributions to research challenges in the relevant GEO domain(s), advancing domain science by leveraging use-inspired AI research, actively building the next generation of talent, and creating a nexus for collaborative research.

GEO is especially interested in research activities which may lead to future successful

proposals for the AI Institutes program or for potential future NSF AI investments.

AI INSTITUTES PROGRAM OVERVIEW

NSF has initiated the AI Institutes program with the first cohort of institutes being recently funded (https://www.nsf.gov/news/special_reports/announcements/082620.jsp). This program is continuing with the active solicitation outlining current priority themes (see NSF 20-604).

Prospective proposers interested in AI Institutes should familiarize themselves with the National AI Institutes solicitation (NSF 20-604) to ensure the proposed coordination and planning activities lead to future research that will be relevant and competitive for NSF funding in GEO-themed AI.

The National AI Research Institutes program, a joint effort of NSF, the US Department of Agriculture, Department of Homeland Security, Department of Transportation, and several industry partners, will fund Institutes comprising scientists, engineers, and educators united by a common focus on advancing the research frontiers in AI. AI Research Institutes will have as their primary focus the advancement of multidisciplinary, multi-stakeholder research on larger-scale, longer-time-horizon challenges in AI research than are supported in typical research grants. They will accelerate the development of transformational technologies by grounding that research in critical application sectors that can serve as motivation for foundational research advances and provide opportunities for the effective fielding of AI-powered innovation.

AI FOR DISCOVERY IN GEOSCIENCES

AI can be a powerful asset to geoscience researchers engaged in tasks such as analyzing large and complex datasets, developing physical models, and designing and deploying sensor networks. But adoption of AI tools is challenging for individual researchers who lack the resources and expertise required to develop and employ them. Adoption is also hampered by the "black box" nature of many AI tools, which are designed for extracting empirical relationships from data rather than developing physical insight and understanding. By pooling expertise in the relevant disciplines and providing shared resources, an AI Institute can make rapid progress in realizing the potential of AI for fundamental geoscience research. Applications in geosciences can also inform and inspire new research directions in AI science.

GEO welcomes AI-themed conference and RCN proposals in and across all research areas supported by the four organizations within the Geosciences Directorate: the Divisions of Atmospheric and Geospace Sciences (AGS), Earth Sciences (EAR), and Ocean Sciences (OCE), and the Office of Polar Programs (OPP). AGS supports research on the composition, physics, and dynamics of the atmosphere and geospace, defined to extend from the sun to the surface of the earth. EAR supports research to improve understanding of the structure,

composition, and evolution of the Earth, the life it supports, and the processes that govern the formation and behavior of the materials that make up the Earth. OCE supports research to advance understanding of all aspects of the global oceans and ocean basins, including their interactions with people and the integrated Earth system. OPP supports research in and about the polar regions that advances the understanding of polar systems and their global interactions or that use the unique characteristics of the polar regions as a platform for observations.

A primary purpose of this DCL is to encourage ideas from the GEO community that share one or more of the following attributes: a groundswell of support from researchers in a GEO domain; are poised to advance forefront research in AI and one or more geosciences; would benefit from large-scale collaborations across GEO and AI domains and institutions; and require multi-institutional resources and efforts to advance discovery and understanding. Owing to the need for community input and collaboration combined with the forward planning for cohorts to form a portfolio of GEO-themed AI projects, either conferences or RCNs may be appropriate. Proposers should choose the proposal type and duration that will lead to forming successful teams to compete for future AI funding including future AI Research Institutes.

HOW TO SUBMIT

GEO anticipates encouraging conference (see PAPPG Chapter II E.7) or RCN proposals (see the RCN solicitation https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17594). RCNs aligned with this DCL should request a maximum award of $300,000 and a duration of 2-3 years. Program Directors may consider ideas for EAGER submissions at their discretion (see PAPPG Chapter II E.2). Interested parties must contact one of the Program Directors listed below, preferably in the Division most relevant to their Geosciences theme to discuss whether a proposal may be submitted in alignment with this DCL. Proposals received in response to this DCL without the written encouragement of one of the Program Directors listed below, may be returned without review. PIs are also encouraged to communicate about their ideas with Program Directors in relevant GEO programs. General inquiries may be directed to skennan@nsf.gov (703-292-7575).

POINTS OF CONTACT

Division of Atmospheric and Geospace Sciences (AGS)
Eric DeWeaver, Program Director, GEO/AGS, (703) 292-8527, email: edeweave@nsf.gov

Division of Earth Sciences (EAR)
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Division of Ocean Sciences (OCE)
Sean Kennan, Program Director, GEO/OCE, (703) 292-7575, email: skennan@nsf.gov

Office of Polar Programs (OPP)
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Sincerely,

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Assistant Director for Geosciences