

DIRECTORATE FOR GEOSCIENCES (GEO)**\$1,236,380,000****GEO Funding**
(Dollars in Millions)

	FY 2022 Actual ¹	Disaster Relief		FY 2023 Estimate Total	FY 2024 Request	Change over FY 2023 Base Total ²	
		Estimate Base	Supplemental Base			Amount	Percent
Atmospheric and Geospace Sciences (AGS)	\$288.17	\$288.00	\$5.89	\$293.89	\$318.61	\$24.72	8.4%
Earth Sciences (EAR)	202.41	202.11	2.00	204.11	213.15	9.04	4.4%
Ocean Sciences (OCE)	418.81	417.05	16.43	433.48	447.43	13.95	3.2%
Research, Innovation, Synergies, and Education (RISE)	126.34	125.10	11.57	136.67	257.19	120.52	88.2%
Total	\$1,035.73	\$1,032.26	\$35.89	\$1,068.15	\$1,236.38	\$168.23	15.7%

¹ Excludes \$40.69 in American Rescue Plan supplemental funding.² Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.**About GEO**

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 resources on which society depends. GEO is home to NSF's atmospheric and geospace, earth, and ocean research activities and provides coordination and administrative oversight to the Office of Polar Programs. GEO investigates diverse Earth system processes including space weather, the planet's water cycle, interactions across the land-ocean-atmosphere interface, the behavior of ice sheets, and geologic processes responsible for a variety of energy sources and strategic minerals. While individual investigators and small teams receive most awards, center scale activity, technology development, and facilities are all integral to the geosciences. This conjunction of approaches enables GEO to invest in compelling basic and use-inspired science that will underpin and enable the advances needed to assure our resilient future. Lives are saved, and property is preserved by better observing, understanding, and forecasting natural phenomena and environmental hazards such as earthquakes, tornadoes, drought, and solar storms.

GEO prioritizes interdisciplinary studies that contribute directly to national research priorities including resilience, equity, security, and economic prosperity. Resilience research and support of the U.S. Global Change Research Program (USGCRP) are areas of emphasis. Investments will focus on predictability and resilience of the Earth system, including abrupt environmental change and extreme events, the role of the oceans in mitigating climate change and as a sink of carbon dioxide, terrestrial-climate interactions, and water sustainability including the impacts and implications of drought and floods. The theme of resilience is utilized to advance social equity and building diverse and inclusive research ecosystems that focus on institutional transformation towards inclusivity.

Inherently observational, geoscience requires research tools and infrastructure to expand the knowledge frontier. Mid-scale research infrastructure in atmospheric, earth, and ocean science continues to be important to the advancement of these disciplines. Large scale research infrastructure, in addition to providing key observational and computational capabilities, offers opportunities for partnerships with international entities, other federal agencies, and other groups.

GEO's FY 2024 Request builds on past efforts and aligns strongly with NSF and national priorities. There are exciting emerging, maturing, and ongoing opportunities and research activities that, in

aggregate, meet important societal goals and transform the Nation's future. GEO investments prioritize:

- sustaining ongoing disciplinary and interdisciplinary research programs;
- supporting the highest quality research performed by individuals, groups, centers, and facilities;
- supporting early-career investigators;
- providing funding for targeted basic and use-inspired research in NSF-wide investments;
- increasing support for resilience and climate research;
- advancing innovation and partnerships to catalyze the path to a more resilient Earth; and
- promoting equity and broadening participation in STEM research.

GEO-funded research supports NSF's key investment themes: Create Opportunities Everywhere, Build a Resilient Planet, Strengthen Research Infrastructure, and Advance Emerging Industries for National and Economic Security.

Create Opportunities Everywhere: GEO will continue to explore ways to identify and address barriers to equity and participation in the geosciences. Efforts include enhancing the support of early-career researchers from a variety of institutions as well as ensuring support for postdoctoral fellows from groups underrepresented in GEO fields of study. In FY 2024, GEO will start a special initiative to support Climate Equity Fellows. This program will train students and researchers in science important for addressing climate change and to be knowledgeable about the disparate impacts of climate change on disadvantaged or underserved communities and to integrate these perspectives into the design of their research projects.

Build a Resilient Planet: In FY 2024, GEO will expand its activities related to risk and resilience. A new effort to build a comprehensive National Resilience Network program will focus on four key areas:

- improving disaster resilience in communities;
- developing technologies needed to advance resilience research;
- implementing a climate innovation challenge to determine the effectiveness, impact, and unintended consequences on proposed and already initiated climate interventions; and
- supporting research on the human health implications of climate change.

Strengthen Research Infrastructure: In FY 2024, GEO will invest in the continued operation and maintenance of major national facilities (see the Major Facility section of the Research Infrastructure Theme for more information). In addition, investments will address maintenance items in the academic research fleet and at the National Center for Atmospheric Research. FY 2024 will also see the initiation of ObsX; a program to develop next generation observing tools and technologies for deployment in and study of extreme environments.

Emerging Industries: In addition to supporting the Nation's need for supplies of the critical minerals that underpin the green revolution, GEO will continue investment in advanced Artificial Intelligence as well as Biotechnology tools and techniques.

Major Investments

GEO Major Investments

(Dollars in Millions)

Area of Investment ^{1,2}	FY 2022 Actual	FY 2023		Change over FY 2023 Estimate	
		Estimate Base Total ³	FY 2024 Request	Base Total ³ Amount	Percent
Artificial Intelligence	\$1.00	\$5.00	\$5.00	-	-
Biotechnology	10.00	10.00	10.00	-	-
Climate: USGCRP	337.60	355.60	479.46	123.86	34.8%
Climate Equity Fellows	-	-	15.00	15.00	N/A
GEO Access	-	-	8.00	8.00	N/A
National Resilience Research Network	-	-	47.50	47.50	N/A
ObsX	-	-	20.00	20.00	N/A
Postdoctoral Research Fellowships	11.76	7.90	13.34	5.44	68.9%

¹ Major investments may have funding overlap and thus should not be summed.

² This table reflects this directorate's support for selected areas of investment. In other directorate narratives, areas investment displayed in this table may differ and thus should not be summed across narratives.

³ Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.

To learn more about the cross-agency themes and initiatives supported by GEO, such as Artificial Intelligence, Biotechnology, and USGCRP, see individual narratives in the NSF-Wide Investments chapter.

- **Climate: USGCRP:** GEO leads NSF efforts to support the goals of the USGCRP. Investments will focus on predictability and resilience of the Earth system, the role of the oceans in climate change, terrestrial-climate interactions, and water sustainability including drought and floods, and the intersection of natural, social, and built systems.
- **Climate Equity Fellows:** will support students and researchers to perform impactful climate change research, to be knowledgeable about the disparate impacts of climate change on disadvantaged or underserved communities, and to work to mitigate those impacts.
- **GEO ACCESS: Accelerating Culture Change in the Earth & Space Sciences (GEO ACCESS),** will build a network of regional-scale consortia focused on developing thriving graduate student cohorts, including the support needed to successfully navigate job and career opportunities.
- **National Resilience Research Network:** A resilient future can only be reached through novel solutions informed by the latest knowledge on the interactions between the natural, human, and built environments. GEO’s vision for a National Resilience Network has four components:
 1. **Disaster Resilient Communities:** Awardees will work closely with local and regional communities to enhance understanding and develop the predictive capabilities needed for a more resilient future with a particular focus on the compounding effects of hazards and extreme events and how these events impact the economy and national security.

2. Tech to Resilience: New technologies are needed to advance understanding of Earth systems and advance clean energy technologies for regional and local adoption.
 3. Climate Innovation Challenge: innovative science and detailed studies on the effectiveness, impact, and unintended consequences on proposed and already initiated climate interventions.
 4. Climate Change and Human Health: As global change intensifies due to human activity, identifying and understanding sources of danger, how the Earth systems work, the transport and alteration of chemical and geobiological species in the natural world, and other geologic processes is key to understanding corresponding changes in human health.
- ObsX: In FY 2024 GEO is forging a new partnership within NSF to create the next generation of observing tools and agile observing platforms. Born from the need to measure and observe in extreme environments (e.g. polar realms, under the seas, deep within the Earth's crust, in the air) the ObsX initiative will support fundamental research into methods, tools, and technologies that will enable large-scale, economical, and remote complex observations across systems and boundaries.
 - Postdoctoral Fellowships: Postdoctoral research is a critical stage in preparation for professional careers. GEO is increasing support for programs to provide fellowships to about 20 additional postdoctoral researchers. These projects support fundamental research in important priority areas such as USGCRP, while also serving broader goals related to inclusivity in the science workforce.

Centers Programs

GEO Funding for Centers Programs

(Dollars in Millions)

	FY 2022 Actual	FY 2023 Estimate	FY 2024 Request	Change over FY 2023 Estimate	
		Base Total ¹		Base Total ¹	Percent
STC: Cntr for Learning the Earth w/ AI and Physics (AGS)	-	\$5.00	\$5.00	-	-
STC: Cntr for Chemical Currencies of a Microbial Planet (OCE)	5.00	5.00	5.00	-	-
Total	\$5.00	\$10.00	\$10.00	-	-

¹ Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.

For detailed information on individual centers programs, please see the Cross Theme Topics section of the NSF-Wide Investments chapter.

Major Facilities

GEO Funding for Major Facilities

(Dollars in Millions)

	Division	FY 2022	FY 2023	FY 2024	Change over FY 2023 Estimate	
		Actual	Base Total ¹	Request	Base Total ¹	Percent
Academic Research Fleet (ARF)	OCE	\$116.39	\$127.11	\$129.23	\$2.12	1.7%
Arecibo Observatory	AGS	9.77	3.00	3.00	-	-
Geodetic Facility for the Advancement of GEoscience (GAGE)	EAR	12.75	13.25	13.82	0.57	4.3%
International Ocean Discovery Program (IODP)	OCE	51.70	50.40	52.77	2.37	4.7%
National Center for Atmospheric Research (NCAR)	AGS	104.64	116.20	134.41	18.21	15.7%
Ocean Observatories Initiative (OOI)	OCE	45.13	51.00	53.36	2.36	4.6%
Seismological Facility for the Advancement of GEoscience (SAGE)	EAR	21.00	22.50	23.49	0.99	4.4%
Total		\$361.38	\$383.46	\$410.08	\$26.62	6.9%

¹ Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.

For detailed information on individual facilities, please see the Research Infrastructure section of the NSF-Wide Investments chapter.

People Numbers and Funding Profiles

For info on NSF's People Numbers and Funding Profile tables, please see the Summary Tables chapter.

DIVISION OF ATMOSPHERIC AND GEOSPACE SCIENCES (AGS)

AGS Funding
(Dollars in Millions)

	FY 2022 Actual ¹	Disaster Relief			FY 2024 Request	Change over	
		FY 2023 Estimate Base	Supplemental Base	FY 2023 Estimate Total		FY 2023 Base Total ²	Percent
Total	\$288.17	\$288.00	\$5.89	\$293.89	\$318.61	\$24.72	8.4%
Research	135.26	143.05	-	143.05	143.74	0.69	0.5%
Education	4.01	3.14	-	3.14	4.68	1.54	49.0%
Infrastructure	148.90	141.81	5.89	147.70	170.19	22.49	15.2%

¹ Does not captured funding provided by the American Rescue Plan supplemental appropriation.

² Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.

AGS supports fundamental research that leads to improved understanding of the physics, chemistry, and dynamics of the Earth’s atmosphere, weather, and climate as well as research and observations to discover how the sun interacts with the Earth's atmosphere and how the atmosphere interacts with other components of the Earth’s integrated systems. Improved understanding drives state-of-the-science model development and predictability of weather, climate, and space weather events. AGS supports fundamental research and the infrastructure, facilities, and services that enable and support modern-day atmospheric and geospace research activities. AGS also enables education and workforce development activities that foster the success of early career scientists and grows a diverse world-class scientific and technical workforce. In general, about 34 percent of the division portfolio is available to support new research grants. The remaining 66 percent supports awards made in prior years.

DIVISION OF EARTH SCIENCES (EAR)

EAR Funding
(Dollars in Millions)

	FY 2022 Actual ¹	Disaster Relief			FY 2024 Request	Change over	
		FY 2023 Estimate Base	Supplemental Base	FY 2023 Estimate Total		FY 2023 Base Total ²	Percent
Total	\$202.41	\$202.11	\$2.00	\$204.11	\$213.15	\$9.04	4.4%
Research	135.26	135.02	-	135.02	134.54	-0.48	-0.4%
Education	7.14	6.71	-	6.71	9.20	2.49	37.1%
Infrastructure	60.01	60.38	2.00	62.38	69.41	7.03	11.3%

¹ Does not captured funding provided by the American Rescue Plan supplemental appropriation.

² Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.

EAR supports fundamental research into the structure and composition of the Earth and the processes that govern it. Research spans the Earth from its surface to its center, and includes its evolution and history, and the life it has sustained over its four and a half billion years. This research

is critical for understanding Earth's environment and its impact on society, including its climate (past, present, future), the distribution of its natural resources (mineral, water, biota, and energy), and the fundamental drivers of geologic hazards. EAR research provides predictive and quantitative understanding of earthquakes, volcanic eruptions, floods, landslides, changing climate, natural resources, and the overall Earth System. EAR education and human resources engages a wide range of audiences in Earth Science research efforts and fosters a just, equitable, diverse, and inclusive culture across the geosciences. In general, about 45 percent of the division portfolio is available to support new research grants. The remaining 55 percent supports awards made in prior years.

DIVISION OF OCEAN SCIENCES (OCE)

OCE Funding
(Dollars in Millions)

	FY 2022 Actual ¹	Disaster Relief			FY 2024 Request	Change over FY 2023 Base Total ²	
		FY 2023 Estimate Base	Supplemental Base	FY 2023 Estimate Total		FY 2023 Base Amount	Total Percent
Total	\$418.81	\$417.05	\$16.43	\$433.48	\$447.43	\$13.95	3.2%
Research	178.11	185.84	-	185.84	186.11	0.27	0.1%
Education	10.76	9.13	-	9.13	10.96	1.83	20.0%
Infrastructure	229.94	222.08	16.43	238.51	250.36	11.85	5.0%

¹ Does not captured funding provided by the American Rescue Plan supplemental appropriation.

² Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.

OCE supports cutting-edge research, education, and infrastructure that advances the Nation's scientific knowledge of the oceans to support the U.S. economy over the long term, provides vital information regarding national security matters such as sea-level rise, and advances U.S. leadership in ocean science and technological innovation. OCE is participating in the United Nations Decade of Ocean Science (2021-2030), through the U.S. National Committee for the Decade, to help ensure sustainable use of ocean resources and long-term ocean health. In general, about 26 percent of the division portfolio is available to support new research grants. The remaining 74 percent supports awards made in prior years.

DIVISION OF RESEARCH, INNOVATION, SYNERGIES, AND EDUCATION (RISE)

RISE Funding

(Dollars in Millions)

	FY 2022 Actual ¹	Disaster Relief			FY 2023 Estimate Total	Change over		
		FY 2023 Estimate Base	Supplemental Base	FY 2023 Estimate Total		FY 2024 Request	FY 2023 Base Amount	Total ² Percent
Total	\$126.34	\$125.10	\$11.57	\$136.67	\$257.19	\$120.52	88.2%	
Research	119.64	120.10	11.57	131.67	224.19	92.52	70.3%	
Education	6.70	5.00	-	5.00	28.00	23.00	460.0%	
Infrastructure	-	-	-	-	5.00	5.00	N/A	

¹ Does not captured funding provided by the American Rescue Plan supplemental appropriation.

² Captures both the FY 2023 Omnibus appropriation and the Disaster Relief Supplemental base.

RISE supports novel, complex, or partnership projects in both research and education. These investments cut across traditional boundaries within the geosciences, encouraging interdisciplinary activities and responding directly to critical needs of the entire geoscience community. RISE’s principal goals are to develop innovative means to initiate and support geoscience education, attract underrepresented groups to careers in the geosciences, foster the interchange of scientific information nationally and internationally, and join with other parts of NSF in major integrative research and education efforts. The division makes strategic investments in multidisciplinary research areas, international activities, education, diversity, and human resource development. The results of RISE investments will assist in ensuring that the United States has a well-educated and diverse workforce in the geosciences and in related technical fields such as resource exploration. In general, about 68 percent of the division portfolio is available to support new research grants. The remaining 32 percent supports awards made in prior years.