DIRECTORATE FOR GEOSCIENCES (GEO) **$1,073,670,000**

GEO Funding[1]

(Dollars in Millions)

	FY 2023 Base Plan[2]	FY 2024 (TBD)	FY 2025 Request	Change over FY 2023 Base Plan Amount	Change over FY 2023 Base Plan Percent
Atmospheric and Geospace Sciences (AGS)	$289.71	-	$293.80	$4.09	1.4%
Earth Sciences (EAR)	201.18	-	204.85	3.67	1.8%
Ocean Sciences (OCE)	427.43	-	440.17	12.74	3.0%
Research, Innovation, Synergies, and Education (RISE)	134.85	-	134.85	-	-
Total	**$1,053.17**	**-**	**$1,073.67**	**$20.50**	**1.9%**

[1] Not included in this display is funding for the Office of Polar Programs (OPP), a division within the Geosciences Directorate. Due to the nature of the activities funded by OPP, this division is provided a full, separate writeup in NSF's Congressional Budget Submission.

[2] For comparability with FY 2025, the FY 2023 level does not include this organization's share of Mission Support Services that was funded through the R&RA and EDU directorates and offices.

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, geospace, earth, and ocean research enterprise from the poles to the equator and provides coordination and administrative oversight to the Office of Polar Programs. GEO invests in investigations of 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 activities, technology development, and facilities are all integral to 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 through improved environmental observing leading to enhanced understanding and advanced forecasting capabilities to predict changes in the Earth system including hazards such as earthquakes, tornadoes, floods, drought, heatwaves, wildfires, 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 and economic equity and building inclusive research ecosystems.

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 critical groups.

GEO's budget 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 to better predict changes in the Earth system;
- 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 (BaRP), 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 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 2025, GEO will invest in a special activity to support research fellowships to advance resilience across the Nation. This program will train students and researchers in science important for addressing resilience and to be knowledgeable about the disparate impacts of hazards on disadvantaged or underserved communities and to integrate these perspectives into research project design.

Build a Resilient Planet: GEO will enable activities related to risk and resilience, focusing on:

- improving resilience to disasters and extreme events in communities;
- incorporating local and indigenous knowledge of climate change and variance in natural resources to improve resilience and mitigation;
- developing technologies needed to advance resilience research;
- determining the effectiveness, impact, and unintended consequences on proposed and already initiated climate interventions such as carbon dioxide removal and solar radiation management; and
- supporting research on the human health implications of climate change.

Strengthen Research Infrastructure: 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.

Emerging Industries: In addition to supporting the Nation's need for supplies of the critical minerals that underpin the green revolution, GEO will continue investments in advancing Artificial Intelligence as a tool for advancing understanding of a changing Earth system. GEO will also continue investments in Biotechnology tools and techniques.

Major Investments

GEO Major Investments

(Dollars in Millions)

Area of Investment[1,2]	FY 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request	Change over FY 2023 Base Plan Amount	Change over FY 2023 Base Plan Percent
Artificial Intelligence	$5.00	-	$5.23	$0.23	4.6%
Biotechnology	10.00	-	10.45	0.45	4.5%
BaRP: U.S. Global Change Research Program (USGCRP)	355.60	-	371.60	16.00	4.5%
Confronting Hazards, Impacts, and Risks for a Resilient Planet (CHIRRP)	-	-	15.00	15.00	N/A
Focus On Recruiting Emerging Climate and Adaptation Scientists and Transformers (FORECAST)	-	-	15.00	15.00	N/A
Resilience Research Innovation Incubators (R2I2)	-	-	5.00	5.00	N/A

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

[2] This table reflects this directorate's support for selected topics. Investment priorities and presentation may differ by organization and so should not be summed across narratives.

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

- BaRP: USGCRP: GEO leads NSF efforts to support the goals of the USGCRP. Investments will focus on advancing scientific knowledge to enhance 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.
- Confronting Hazards, Impacts, and Risks for a Resilient Planet (CHIRRP): CHIRRP is a bold and strategic activity to catalyze convergent Earth system science, build community partnerships and generate actionable solutions to safeguard communities and ecosystems for a resilient planet.
- Focus On Recruiting Emerging Climate and Adaptation Scientists and Transformers (FORECAST): Focused on individuals from communities that have traditionally been underrepresented in STEM, FORECAST will make resilience research relevant to students and equip participants with the broader skills necessary to excel in their future endeavors inside or outside academia.
- Resilience Research Innovation Incubators (R2I2): Awards will create translational research incubators to address high-impact global environmental change problems that society is facing today. R2I2 awards will prioritize research collaborations fostering team science, community-engaged research innovation, and knowledge-to-action frameworks. Each incubator brings together teams to maximize the benefits of interdisciplinary collaborations within regional R2I2 geographic domains and enable breakthroughs via partnerships between the private sector, academia, local and state governments, and relevant community stakeholders.

Centers Programs

GEO Funding for Centers Programs

(Dollars in Millions)

	Division	FY 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request	Change over FY 2023 Base Plan Amount	Change over FY 2023 Base Plan 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	-	-
Total		**$10.00**	**-**	**$10.00**	**-**	**-**

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 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request	Change over FY 2023 Base Plan Amount	Change over FY 2023 Base Plan Percent
Academic Research Fleet (ARF)[1]	OCE	$136.09	-	$151.33	$15.24	11.2%
National Center for Atmospheric Research (NCAR)	AGS	116.20	-	124.59	8.39	7.2%
National Geophysical Facility (NGF)[2]	EAR	35.75	-	43.26	7.51	21.0%
Geodetic Facility for the Advancement of Geoscience (GAGE)[2]		13.25	-	7.32	-5.93	-44.8%
Seismological Facility for the Advancement of Geoscience (SAGE)[2]		22.50	-	12.45	-10.05	-44.7%
National Geophysical Facility (NGF)		-	-	23.49	23.49	N/A
Ocean Observatories Initiative (OOI)[1]	OCE	42.02	-	47.76	5.74	13.7%
U.S. Sub-seafloor Sampling (S3P) [*formerly International Ocean Discovery Program (IODP)*]	OCE	50.40	-	55.51	5.11	10.1%
Total		**$416.21**	**-**	**$465.71**	**$49.50**	**11.9%**

[1] FY 2023 Base Plan restated to reflect the transfer of ship-time costs (estimated at $8.98 million) from the Ocean Observatories Initiative (OOI) into the Academic Research Fleet (ARF).

[2] In FY 2025, GAGE and SAGE will be consolidated into a single facility called the "National Geophysical Facility (NGF)."

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

GEO Divisions

GEO Division Funding by Category[1]

(Dollars in Millions)

	FY 2023 Base Plan[2]	FY 2024 (TBD)	FY 2025 Request	Change over FY 2023 Base Plan Amount	Change over FY 2023 Base Plan Percent
AGS	**$289.71**	**-**	**$293.80**	**$4.09**	**1.4%**
Research	138.87	-	136.32	-2.55	-1.8%
Education	3.14	-	3.14	-	-
Infrastructure	147.70	-	154.34	6.64	4.5%
EAR	**$201.18**	**-**	**$204.85**	**$3.67**	**1.8%**
Research	132.09	-	128.25	-3.84	-2.9%
Education	6.71	-	6.71	-	-
Infrastructure	62.38	-	69.89	7.51	12.0%
OCE	**$427.43**	**-**	**$440.17**	**$12.74**	**3.0%**
Research	179.79	-	166.44	-13.35	-7.4%
Education	9.13	-	9.13	-	-
Infrastructure	238.51	-	264.60	26.09	10.9%
RISE	**$134.85**	**-**	**$134.850**	**-**	**-**
Research	129.85	-	97.15	-32.70	-25.2%
Education	5.00	-	37.70	32.70	654.0%
Infrastructure	-	-	-	-	N/A

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[2] For comparability with FY 2025, the FY 2023 level does not include this organization's share of Mission Support Services that was funded through the R&RA and EDU directorates and offices.

Atmospheric and Geospace Sciences (AGS). 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.

Division of Earth Sciences (EAR). EAR supports fundamental research into the structure and composition of the Earth and the processes that govern it. Research spans from the Earth's 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 engage a wide range of audiences in Earth science research efforts and foster a just, equitable, diverse, and inclusive culture across the geosciences.

Division of Ocean Sciences (OCE). 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 a variety of national efforts that help ensure sustainable use of ocean resources and long-term ocean health.

Division of Research, Innovation, Synergies, and Education (RISE). RISE supports transdisciplinary collaborations that engage the broader community to drive transformative discoveries, innovations in workforce development, and use-inspired solutions for urgent Earth system challenges. These investments cut across traditional boundaries, encouraging interdisciplinary activities and responding directly to critical societal needs. 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 transdisciplinary research areas, international activities, education, diversity, and human resource development. The results of RISE investments will assist in ensuring that the U. S. has a well-educated and diverse workforce in the geosciences and in related technical fields.

Office of Polar Programs (OPP). See the separate, full narrative, *Geosciences: Office of Polar Programs (OPP),* within the R&RA chapter.