

## U.S. GLOBAL CHANGE RESEARCH PROGRAM (USGCRP)

<b>Total Funding for USGCRP</b>			
<b>(Dollars in Millions)</b>			
	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>
	<b>Actual</b>	<b>(TBD)</b>	<b>Request</b>
BIO	\$90.00	-	\$88.25
GEO	120.00	-	106.50
SBE	16.50	-	11.73
OPP	14.28	-	10.61
<b>Total</b>	<b>\$240.78</b>	<b>-</b>	<b>\$217.09</b>

### Overview

NSF addresses global change issues through investments that advance frontiers of knowledge, provide state-of-the-art instrumentation and facilities, develop new analytical methods, and enable cross-disciplinary collaborations while also cultivating a diverse, highly-trained workforce and developing educational resources. NSF's global change-related programs support the research and related activities to advance fundamental understanding of physical, chemical, biological, and human systems and the interactions among them. Programs encourage interdisciplinary approaches to studying Earth system processes and the consequences of change, including how humans respond to changing environments and the impacts on ecosystems and the essential services they provide.

NSF has been investing in the fundamental research at the heart of global change issues for several decades. Long-term, continuous, and consistent observational records are essential for testing hypotheses quantitatively and are thus a cornerstone of global change research. NSF supports a variety of research observing networks that complement, and are dependent on, the climate monitoring systems maintained by its federal partners. The results of NSF investments have helped communities address challenges associated with mitigation, adaptation, and other responses to a changing and variable environment.

NSF funding for USGCRP in the FY 2021 Request is \$217.09 million. NSF's investments will continue to support research that contributes to the USGCRP Goal Areas to (1) advance scientific knowledge of the integrated natural and human components of the Earth system and (2) inform decisions by providing the scientific basis to inform and enable timely decisions on adaptation and mitigation. In FY 2021, NSF will continue to engage with other USGCRP agencies on priorities from intra-seasonal to centennial predictability, predictions, and projections; water cycle research; understanding the impacts of global change on the Arctic region and effects on global climate; and fundamental research on actionable science. In addition, NSF will further seek greater integration of social-science research, methodologies, and insights into understanding and supporting responses to global change, improving computing capacity, and maintaining needed observational capabilities over time.

Past investments have helped inform the National Climate Assessment and several other technical reports mandated by the Global Climate Research Act of 1990. Investments have also aided U.S. communities to develop mitigation and adaptation strategies to address both challenges and opportunities derived from a changing environment. The fundamental knowledge gained through NSF disciplinary and cross-cutting programs focusing on the coupled natural-human system are critical in developing effective solutions to these challenges and opportunities.

## **FY 2021 Investments by Program Component Area (PCA)**

### Goal 1: Advance scientific knowledge of the integrated natural and human components of the Earth system

*Earth System Understanding:* NSF participates in the Earth System Understanding PCA to improve our knowledge of the Earth's past and present climate variability and change through activities to document and understand long-term climate cycles across the globe, as well as to better understand the natural variability of climate and the processes responsible for global changes using a range of paleoclimate and instrumental data and modeling approaches. NSF also supports activities to improve our understanding of the frequency and intensity of extreme climate events, particularly wet and dry extremes of the water cycle, their causes, and how those may be manifested in the future. Upgrading and expanding critical environmental observing systems are vital to these efforts.

NSF also supports Earth System Understanding through activities spanning a broad range of disciplines and topics that seek to better understand the physical, geological, chemical, biological, and human components of the Earth system and their interactions. Examples of major foci include fundamental research on all aspects of the carbon cycle, the water cycle, atmospheric composition and greenhouse gas processes, marine and terrestrial ecosystems, and ocean and atmospheric circulations that both drive and respond to climate and global change. Human drivers of change include urbanization, population growth, and economic and technological development over a range of temporal scales and NSF has a strong commitment to fostering new interdisciplinary research approaches that allow exploration of the interdependencies across these areas.

*Integrated Observations:* NSF contributes to the Integrated Observations PCA through its advanced capabilities to observe the physical, chemical, biological, and human components of the Earth system over multiple space and time scales. Facilities such as the Academic Research Fleet and the National Ecological Observatory Network assist the Nation in gaining a fundamental scientific understanding of the Earth as well as monitor important variations and trends that allow the research community to examine major feedback processes between the climate and natural and human systems.

*Integrated Modeling:* NSF will continue to devote significant resources to advancing climate modeling capabilities from global and centennial to regional and decadal scales. Since there is increasingly deep interplay among observations and modeling at multiple spatial and temporal scales, a high priority will be given to developing more complete representations—models of coupled interactive atmospheric chemistry, terrestrial and marine ecosystems, biogeochemical cycling, and middle atmospheric processes. In addition, NSF is encouraging the development of ecosystem and water models at regional scales, as well as models that integrate human system components such as risk, vulnerability, and decision-making.

### Goal 2. Inform Decisions: Provide the scientific basis to inform and enable timely decisions on adaptation and mitigation

*Inform Adaptation and Mitigation:* A key focus of the USGCRP is developing better means of assessing and responding to the impacts of global change as well as the vulnerability and resilience of both human and natural systems to those changes, particularly in highly sensitive regions such as the Arctic. In addition to supporting research that will inform adaptation decisions, NSF will also support fundamental research regarding the science of adaptation, defined as the adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects. This research ranges from developing the theoretical framework for evaluating adaptation options (and avoiding unintended consequences of adaptation choices) to risk assessment and decision-making. NSF will continue interdisciplinary research (including human factors) in water sustainability, resiliency, biodiversity, ocean acidification, and vulnerable areas, particularly in the rapidly changing Arctic.

**USGCRP Funding**

(Dollars in Millions)

	FY 2019 Actual	FY 2020 (TBD)	FY 2021 Request
Integrated Observations	\$90.00	-	\$84.50
Multidisciplinary Earth and Human System Understanding	113.26	-	98.07
Integrated Modeling	27.15	-	24.60
Science of Adaptation and Science to Inform Adaptation Decisions	10.36	-	9.92
<b>Total</b>	<b>\$240.78</b>	<b>-</b>	<b>\$217.09</b>