Program Plan
FY24-FY29

NASA Disasters Program

EARTH ACTION
EARTH SCIENCES DIVISION
NASA HEADQUARTERS

1.0 Introduction

The NASA Disasters Program advances access to and application of Earth science information to build communities resilient to disasters and extreme events. The program supports cutting-edge approaches to understand and model both the physical manifestation of hazards and their effects on populations and infrastructure. Historically, the Disasters Program focused on advancing the use of Earth observations to improve the science of natural hazards. This approach limited the scientific community's ability to evaluate how the impacts of environmental and climactic change are evolving over time and leading to more extreme and crippling crises. Over the next five years, the Program is expanding its outlook and objectives to integrate the elements that turn a natural hazard into a disaster – the nexus between human development and environmental and climatic change, more commonly referred to as vulnerability and exposure. This transition will reflect a pivotal shift in the program and enable Earth science to be advanced in ways that move us beyond disaster response and into disaster resilience.

The vision of the Disasters Program is to inspire and evolve the use of Earth science data and information to build disaster-resilient communities. We achieve this vision by building strong bridges with the disaster management community to 1) co-design and scale Earth observations-based solutions for disaster risk reduction, recovery, and resilience via the Disasters Science to Action Portfolio, 2) rapidly provide cutting-edge Earth science solutions to operational disaster response communities during a disaster through the Disasters Response Coordination System, and 3) build Earth observations-based skilled and effective disaster management communities through the Disasters Portal.

Disasters occur when a slow- or sudden-onset natural hazard disrupts the functioning of a community and interacts with conditions of exposure, vulnerability, and capacity, leading to human, material, economic, and environmental losses and impacts. Extreme events and extreme climate events are drivers of increasing impact to the vulnerability and exposure of populations, reducing the ability for communities to adapt over time and build resilience to future disasters and extreme events. Disasters can occur in isolation, but it is with growing frequency that cascading, compound and complex events occur. Cascading disasters have a primary event that triggers one or more unexpected, secondary events of strong impact (e.g., the 2011 Tohoku earthquake and tsunami that led to the failure of the Fukushima Daiichi nuclear plant). Compound risks are multiple concomitant extreme events that are multivariate, concurrent, or happening in succession (e.g., the 2023 atmospheric rivers in California that produced heavy rainfall and flooding and triggered a series of landslides across the region). Finally, complex events occur when protracted crises, including conflict, disease outbreaks, and disasters, occur simultaneously. When cascading, compound, and complex risks reach a global scope, there is a potential that they become catastrophic and even existential.

Advancing the scientific and technological understanding of the complexity of disasters and associated disaster risks over short-term and protracted temporal scales is essential for improving disaster preparedness and risk reduction, early warning, response, and recovery. It could also inform enhanced modeling of major systemic risks and their associated impacts on lives and livelihoods to achieve disaster resilience. This advancement requires building multidisciplinary teams that connect natural hazards to their impacts, using novel approaches to integrate exposure and vulnerability, conducting retrospective analyses to better understand future extremes, and expanding the methods and models used for integrating spatiotemporal contexts and complexities related to disaster risk. NASA's ability to view Earth from the unique vantage point of space provides a broad and integrated set of uniformly high-quality data covering all parts of the planet. These data help inform decision-makers across all levels of Government—as well as industry, disaster prevention and response, and agriculture—to make policy and operational decisions to address climate change.

2.0 Program Overview

The Program is comprised of three core elements to effectively achieve the Program's vision and implement the Program Plan – the Disasters Science to Action Portfolio, the Disasters Response Coordination System, and the Disasters Partnership and Learning Platform.

The **Disasters Science to Action Portfolio (D-SAP)** comprises all competed and directed support of projects that design decision-support tools for the disaster management community. This Portfolio addresses the most critical questions in disaster management today, including 1) assessing the dynamic nature of natural hazards and extreme events under a changing climate, 2) understanding the complexity of disaster risk and disaster recovery over short-term and protracted time scales, 3) enhancing modeled approaches of major systemic disasters and their associated impacts on lives and livelihoods to achieve disaster resilience, and 4) identifying new

methods for addressing the complexity of cascading, compound, and complex disasters and the long-term implications of catastrophic and existential risks. This Portfolio requires building multidisciplinary teams that connect natural hazards to their impacts, the use of novel approaches to integrate exposure and vulnerability, conducting retrospective analyses to better understand future extremes, and expanding the methods and models used for integrating spatiotemporal contexts and complexities related to disaster risk.

The **Disasters Response Coordination System (DRCS)** is a dedicated effort to provide comprehensive support and coordination to partners in the operational disaster response sector. A Disasters Project Office will coordinate this formalized approach to response. This ensures the equitable distribution of effort and funding across six NASA Centers – Ames Research Center, Goddard Space Flight Center, Jet Propulsion Lab, Johnson Space Center, Langley Research Center, and Marshall Space Flight Center. It includes dedicated staff that will leverage the best available science, technology, and expertise to effectively deploy partner-requested scientific information during active disaster response. It also ensures regular adaptation and learning through the comprehensive after-action assessment process (*see* DRCS Concept of Operations and DRCS Playbook).

The **Disasters Partnership and Learning Platform (DLP)** of the Disasters Program is dedicated to advancing the awareness, understanding, and application of Earth science information for disaster management communities. This requires understanding the needs of our partners through regular engagement and needs assessments to ensure that the program learns and adapts as the science and partner needs change over time. It requires education and collaborative learning through webinars, tutorials, and story maps that effectively communicate and train partners to use Earth science information more effectively. Finally, it requires a testbed for experimental products for observing and modeling capabilities and collaborating with partners to test and provide feedback on novel approaches. The Disasters Portal is the principal open-access hub by which all partnerships, products, and tools of the D-SAP and the DRCS are managed. The **Disasters Portal** is transitioning into a cloud-based enterprise to improve the archiving of products and applications and support the reproducibility and scalability of functions. This approach advances data fusion capabilities to allow partners to effectively compare and contrast diverse data sets, such as socioeconomic data with hazard information and will provide consistent and evolving support for tools and applications across the disaster management cycle.

2.1 Goals and Objectives

The vision of the Disasters Program is to inspire and evolve the use of Earth science data and information for building disaster-resilient communities across the United States and the globe. We achieve this vision by building strong bridges with the disaster management community to 1) co-design and scale Earth observations-based solutions for disaster risk, recovery, and resilience via the **Disasters Science to Action Portfolio**, 2) rapidly provide cutting edge Earth science solutions to operational disaster response communities during a disaster through the **Disasters Response Coordination System**, and 3) build skilled and effective disaster management communities through the **Disasters Portal**. The goals and objectives of each of these three Program elements are reflected below.

Goal 1: Prevent or mitigate the loss of lives and livelihoods from disasters domestically and globally by expanding the access and use of Earth science solutions for improved risk reduction, recovery, and resilience.

Objective 1: Facilitate and develop action-oriented collaborations that help build lasting connections across academia and the public and private sectors working in disaster management.

Objective 2: Advance the scientific community's understanding on how to better address the integration of exposure and vulnerability data into Earth observations products and tools.

Objective 3: Support the evolution of the use of Earth observations to address complex issues relating to migration and displacement, crisis, security, and conflict.

Goal 2: Increase the integration and use of Earth observations data and information products to aid situational awareness and facilitate improved response of emergency responders.

Objective 1: Train, test, and adapt the response community's capacity to use new data and novel applications of Earth observations.

Objective 2: Build skilled and effective response communities through improved coordination, engagement, and learning.

Objective 3: Reduce impact on lives and livelihoods by empowering communities to respond to disasters more effectively.

Goal 3: Build knowledgeable and skilled disaster management communities through engagement, education, and training, and the incubation and testing of new ideas and approaches.

Objective 1: Ensure regular consultation with partners and stakeholders on their decision-support needs and how to sustain, scale, and increase anticipated outcomes of efforts stemming from these exchanges.

Objective 2: Develop a strategy for addressing community needs for training, education, and exchange, and ensure exploration, coordination and communication of opportunities across Earth Action where available (e.g., ARSET).

Objective 3: Advance the opportunities for partners and science teams internal and external to NASA to develop and test new methods for modeling, data integration and automation, as well as product development to advance science and improve likelihood of developing scalable tools.

2.1.1 Alignment with SMD, ESD and Earth Action Strategies

The goals and objectives of the Disasters Program are closely aligned with strategic goals outlined by NASA's Strategic Plan, the Science Mission Directorate (SMD), the Earth Sciences Division (ESD), and ESD's Earth Action Program (EAP). NASA's Strategic Plan 2022 highlights NASA's ability to view Earth from the unique vantage point of space and provide an integrated set of uniformly high-quality data across the planet, which help inform decisions-makers across society to address the threat of climate change and guide efforts related to disaster mitigation.

The 2023-2024 SMD Strategy highlights the importance of 1) a user-focused approach to applied programs and influencing best practices that meet the needs of communities that NASA data can positively affect; 2) fostering a culture that encourages collaboration in pursuit of common goals by engaging with NASA Centers to make more informed strategic decisions; 3) increase the diversity of thought and backgrounds represented, and develop a community that reflects the diversity of a nation. The Earth Science to Action Strategy is the Earth Science Division's 2024-2034 strategic plan. It represents the first update to the division's overall strategy since 2003 and serves as our response to the 2017 National Academies of Sciences and Engineering Earth Sciences decadal survey, which presented a paradigm over the coming decade for Earth Science and Applications to focus on understanding and reliably predicting the many ways the planet is changing. The Earth Science Division (ESD) Earth Science to Action Strategy addresses this paradigm through its strategic goal of advancing and integrating Earth science knowledge to empower humanity to create a more resilient world. ESD's new Earth Action Program (EAP) is managed in parallel with the Program areas in Flight, Earth Science Data Systems, the Earth Science Technology Office, and Research & Analysis. The EAP is dedicated to accelerating the impacts from NASA's Earth science activities by building bridges, advancing user-centered design, and developing scalable solutions for society.

2.2 Stakeholders, Partners, and Beneficiaries

The Disasters Program utilizes a partner-centered design approach that is central to advancing science-informed decision-making for improved disaster management. Partners are central to the three Disasters Program elements and engage with the program in different ways, including leading or partnering on proposals under the Disasters Science to Action Portfolio, requesting assistance for operational disaster response through the Disaster Response Coordination System, and/or through engaging in our Disaster Partnership and Learning Platform.

Reflected below are those communities that the Program intends to work closely with in order to 1) understand and articulate the needs of the disaster management communities to advance science and technology at NASA, 2) identify evolving scientific and technological advances across NASA and communicate opportunities to partners, and 3) provide regular opportunities for communication, technical exchange, training, and learning.

Disaster Risk Management

These communities are diverse and extensive across sectors and levels of governance. Examples include the United Nations Office for Disaster Risk Reduction, the World Bank's Global Facility for Disaster Risk and Resilience, and the American Red Cross' Global Disaster Preparedness Center. They are often interested in understanding the impacts of past disasters – across economies, societies, environments, and governments – in order to mitigate or prevent future disaster risk and build more resilient communities. The limitations to serving this community lie with approaches being anchored to project-funded elements that are not cataloged and characterized in aggregate form to inform systemic understanding of disasters across time – it can be sector-led and therefore sector-specific (e.g., risk financing, gender and social inclusion, environmental security). Though they often employ monitoring, evaluation, and learning (MEL) approaches, the use of Earth science information is largely absent from their evaluation process.

There is extensive opportunity here to advance the use of science in both informing systemic disaster risk management, as well as the use of science to advance the assessment of MEL across their programming.

Multi-hazard Early Warning and Anticipatory Action

Early Warning System (EWS) communities are largely represented by national hydrometeorological, land management, and geohazards agencies (e.g., USGS, NOAA, USFS, and more) and are interested in expanding into multi-hazard EWS, which require additional complexities in science and in capacity building. Anticipatory action communities are largely humanitarian communities working with diverse financial sectors in order to use EWS triggers to release funds to local communities before a disaster occurs so that impacts can be mitigated. This requires advancing the science and certainty for early warning triggers and working with humanitarian organizations to establish risk-averse thresholds for decision-making. Their data needs include vulnerability and risk assessments, monitoring critical infrastructure, predicting hazardous areas and secondary events, and after-action assessments that record lessons and improve future responses. Furthermore, there are opportunities to advance the use of science in these sectors where hazards are cascading or compound, as many multi-hazard approaches treat hazards as individual events instead of multipliers of impact as they concomitantly occur.

Disaster Preparedness, Response, and Recovery

Emergency response communities include all personnel necessary for active crisis events and largely include federal/national, state/regional, and local public safety, law enforcement, emergency response, and emergency medical entities. This community includes actors such as private sector entities, Offices of Emergency Management and the UN Office for the Coordination of Humanitarian Affairs, Red Cross National Societies, and those working in the provision of fundamental services to the community, including energy, health, infrastructure, transportation, and communication (commonly referred to as “lifelines”). Their needs are focused directly on the active disaster response cycle of 1) preparing operational teams for deployment during blue-sky periods, 2) receiving early warning and other information to support staging/pre-positioning of personnel and supplies in advance of an imminent disaster, 3) actively running operational response on the ground during a disaster, and 4) transitioning communities from disaster response into recovery, and eventually into rebuilding. The limitation with serving this community can often be the paucity of low-latency Earth-observing products and the lack of consideration for applications/decision-support tools in the development of new missions. This constraint can often render the science insufficient for this community’s needs. There is an interest across this community to improve their understanding and decision support on predicting future disaster impacts (to improve response), and to advance their ability to address cascading, complex, and compound disaster events.

Humanitarian Development, Environmental Security, and Crisis Management

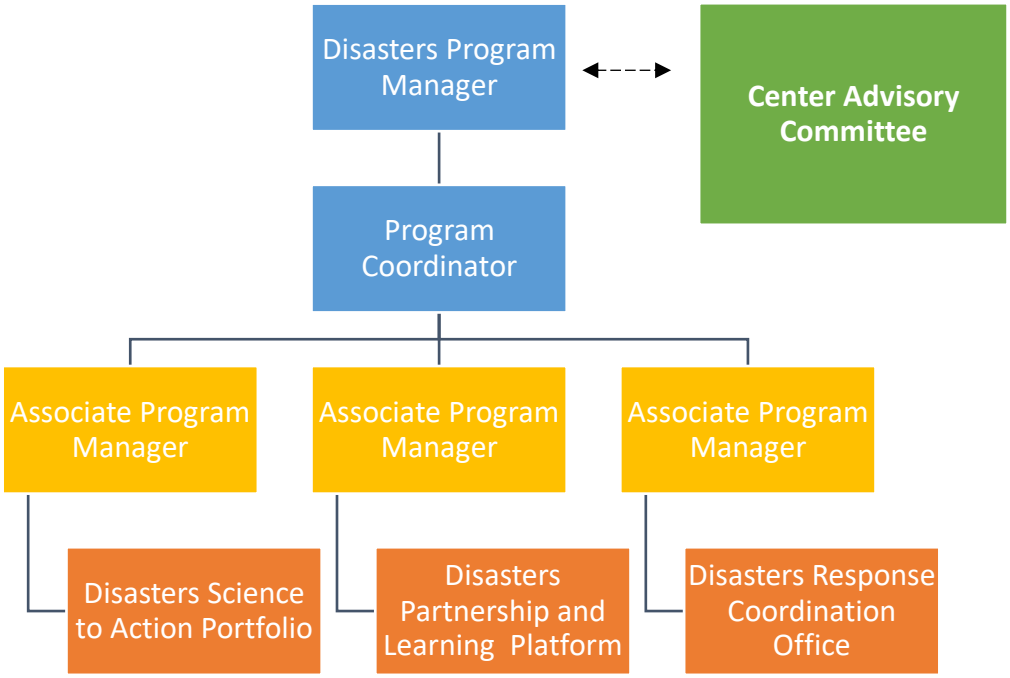
These communities are often interested in systemic approaches to addressing environmental and climate change, the impacts and drivers at the nexus between human and environmental systems, and are interested in using Earth science to inform a range of complex decisions. These groups can include multiple actors across the United Nations landscape, including UN OCHA, UN

Environment Program, the World Food Programme, as well as others including Mercy Corps, DevGlobal, Environmental Law Institute and related Environmental Peacebuilding Association, the World Bank Global Crisis Risk Branch, among many others. The challenges addressed by these actors are diverse given the nature and extent of protracted crises, and they largely range from needing more international coverage of capabilities, improved approaches to understanding drivers of change and connected systems, and scenarios that enable visualization of complex, compound, and cascading scenarios so that connections between poor natural resource management, environmental degradation, disasters, and conflict are better understood.

2.3 Program Authority and Management Structure

The Disasters Program is housed within the Earth Sciences Division (ESD) in the Science Mission Directorate (SMD) at NASA Headquarters.

In terms of budget, the program is an element under the Applied Sciences Program under the ESD budget. The Disasters Program currently has three elements, as follows: 1) the Disaster Science to Action Portfolio, 2) the Disaster Response Coordination System, and 3) the Partnership and Learning Platform.



Disasters Program Manager

The program is led by the Disasters Program Manager (DPM) within the Earth Action section of ESD. The DPM's responsibility includes setting the program's direction and overseeing implementation in terms of cost schedule and performance. The DPM is responsible for short- and long-range program design and planning, cost analyses and budget management, and definition and implementation of programs dedicated to advancing knowledge of using Earth science information for disaster management. This includes the development of competed

solicitations, evaluation and coordination of plans, programs, and budget across three Program elements and NASA Centers, keeping abreast of developments in science and technology, and interacting, sharing, and leading engagement across relevant communities and stakeholders.

Center Advisory Council

The Center Advisory Council (CAC) provides guidance and insight to the Disasters Program in relation to Center direction and vision, and capacity and expertise in order to ensure a one-NASA approach to advancing science and technology for disaster resilience. The CAC is comprised of Earth Science Leadership from each of the six NASA Centers most relevant to disaster management, including Ames Research Center, Goddard Space Flight Center, Jet Propulsion Lab, Johnson Space Center, Langley Research Center, and Marshall Space Flight Center. The DPM and the CAC meet quarterly to ensure alignment of interests and objectives, identify new opportunities for collaboration, and raise challenges or issues that are relevant across the Program and Centers that are focused on disaster-related issues. While managed informally, the CAC provides an invaluable function for ensuring lasting partnerships between the Program and Centers.

Program Coordinator

The Program Coordinator (PC) works across the three Program elements to ensure coordination, scheduling and planning, and communication between the DPM and the APMs. The PC keeps the Program on schedule for reporting to leadership, planning and budgetary requirements, interacts across teams to promote the successful and timely completion of projects, and represents the program on interagency and international activities (e.g., GEO and CEOS). The PC manages the development of a monitoring, evaluation, assessment, and learning roadmap that ensures the Program and three Program elements are able to achieve their stated objectives and intended impact.

Associate Program Managers

The Associate Program Managers are responsible for executing on the progress, reporting, and budget of the Disasters Science to Action Portfolio, the Disasters Response Coordination System, and the Disasters Partnership and Learning Platform. The APMs for the D-SAP and PLP portfolios manage all competed and directed projects of the Disasters Program to ensure projects meet schedule, cost, and performance expectations. They work with the Program Manager to support the implementation of the Program Plan, monitor and evaluate performance to improve future approaches and identify opportunities for partnership and scientific and technical advancement. They will develop and operate these activities in alignment with the D-SAP and PLP Project Plans and will conduct stakeholder needs and impact assessments to ensure integration, scalability, and impact of capabilities. The APM for the DRCS will serve as the Manager of the DRCS project office and will manage coordination across the six NASA Centers of the DRCS. They will develop and operate the project office in alignment with the Disasters Program Plan, and as reflected in the DRCS Concept of Operations Manual. They will conduct and utilize needs assessments and after-action assessments for annual planning, and meet financial reporting requirements. All APMs will identify issues for the Program Manager's attention, maintain existing and develop new

partnerships, nurture a robust disaster science community, and communicate results and accomplishments.

3.0 Program Schedule, Milestones, & Metrics

Schedule and milestones for the Disasters Program Plan for FY24-29.

Metrics for evaluating the effectiveness of the goals and objectives and the related schedule and milestones for the Disasters Program Plan for FY24-FY29:

Outcomes	KPI	Target	How to Measure	How often to measure
Improved awareness of value of EO for disaster management	Number of partners engaged, and diversity of partners engaged	5 new partners, communities, science teams proposing	Proposal metrics	Tethered to competed and directed solicitations (annually/biannually)
Strengthened capacity of community using EO for disaster management	Application of community and partner surveys to determine metrics of impact	Improved understanding of pathways to impact and sustainability (through storytelling, surveys, etc.)	Surveys, assessments, and communications	Quarterly and annually
Advance Disaster data and information for disaster response.	Expand number of EO missions/instruments used in response products	2 missions	After-action Assessment	Quarterly and annually
Build skilled and effective response communities.	# of trainings provided to DRCS network and partner organizations	2 trainings	Post-training reports and survey responses	Quarterly and annually
Address product and training needs of partner and stakeholder community.	Number and diversity of participating entities	2 new participating partners and stakeholders per workshop and training	Community survey, attendance and participation in program activities	Quarterly and annually
Advance new collaborations across ESD and SMD	Number of new collaborations across ESD	2 new collaborations	Proposal metrics, participation in science panels, or other strategic collaborations	Annually

3.1 Program Resources

The 2025 President's Budget Request to achieve the above-mentioned goals, objectives, and schedule is reflected below.

2025 Pres. Budget Request ($K)	FY 24	FY25	FY26	FY27	FY28	FY29
Program Budget	$5,695	$9,024	$9,185	$9,500	$9,500	$10,000

3.2 Relationship to NASA Divisions and Programs

Coordination across ESD is essential for the program's success. At the operational level, many of ESD's spaceflight missions are directly beneficial to the disaster community, and data from them are used in disaster responses.

Missions

The program actively coordinates with most missions, from formulation and development early adopter programs to the range of missions related to the upcoming Earth System Observatory, as well as with the International Space Station instruments such as EMIT and the crew Earth observations. The Program also regularly invites science teams from across science missions to present on the capabilities of the mission to the program and identify opportunities for collaboration and advanced use of mission capabilities. Previous exchanges occurred with science teams from Black Marble, PACE, EMIT, and future plans include SWOT, TROPICS, and PREFIRE.

Earth Science Technology Office

At the foundational level, the Program coordinates regularly with the Earth Science Technology Office's (ESTO) Advanced Information Systems Technology Program to co-design and co-fund solicitations that advance disaster science, particularly technologies that improve access to NASA data and visualization of complex disaster events, such as digital twins.

Earth Science Data Systems

The Program's Disasters Portal is under development through close coordination with the Earth Science Data Systems (ESDS) Program to ensure alignment with the Open Science and Distributed Active Archive Centers data management plans. There is increasing collaboration with the DAACs, and groups such as LANCE and SPoRT will expand possible insights to the communities the Program supports.

Research & Analysis

In order to continuously advance the understanding and use of hazard science research, the Program collaborates regularly with the Research & Analysis Focus Areas, including Weather and Earth Surface & Interior. Improved collaboration with Atmospheric Composition, Climate Variability & Change, and Water & Energy Cycle areas are planned given their important influence on understanding the changing nature of hazards.

Earth Action and Applied Science

Finally, the Program also coordinates across multiple Programs under Earth Action, including Water, Agriculture, Wildland Fire and FireSense, Health and Air Quality, Climate and Community Action, Infrastructure and Sustainable Energy, and Capacity Building. More recent collaborations proving essential to the Program include participation in the Satellite Needs Working Group (and leading the Group in Disaster Response) and the Commercial SmallSat Data Acquisition Program.

Science Mission Directorate

The Disasters Program also collaborates outside of the Earth Science Division by working with the Heliophysics Space Weather Program to regularly collaborate and share practices relating to coordination between space weather incident response and support by the DRCS through annual tabletop exercises, team building, and opportunities for engagement and learning. The Program also work with Planetary Sciences to collaborate on planetary security tabletop exercises and other preparedness plans related to coordination of operations for near-Earth objects.

Cross-Directorate

Beyond SMD, the Disasters Program is a core member of the NASA SMD, ARMD, and STMD Fire Initiative and coordinates regularly with the ESD Wildland Fire Program to ensure that there is coordination, communication, and collaboration across the community when the DRCS is activated for supporting disaster response related to active wildfires.

Finally, the Disasters Program is working to improve collaboration and coordination across NASA's internal Office of Protective Services, which employs emergency managers across NASA Centers that have unique roles in ensuring the safety and security of NASA's assets and to the surrounding communities connected to NASA's Centers. Moving forward, the DRCS will have an important role in improving partnerships with this critical community at NASA.