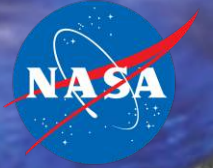


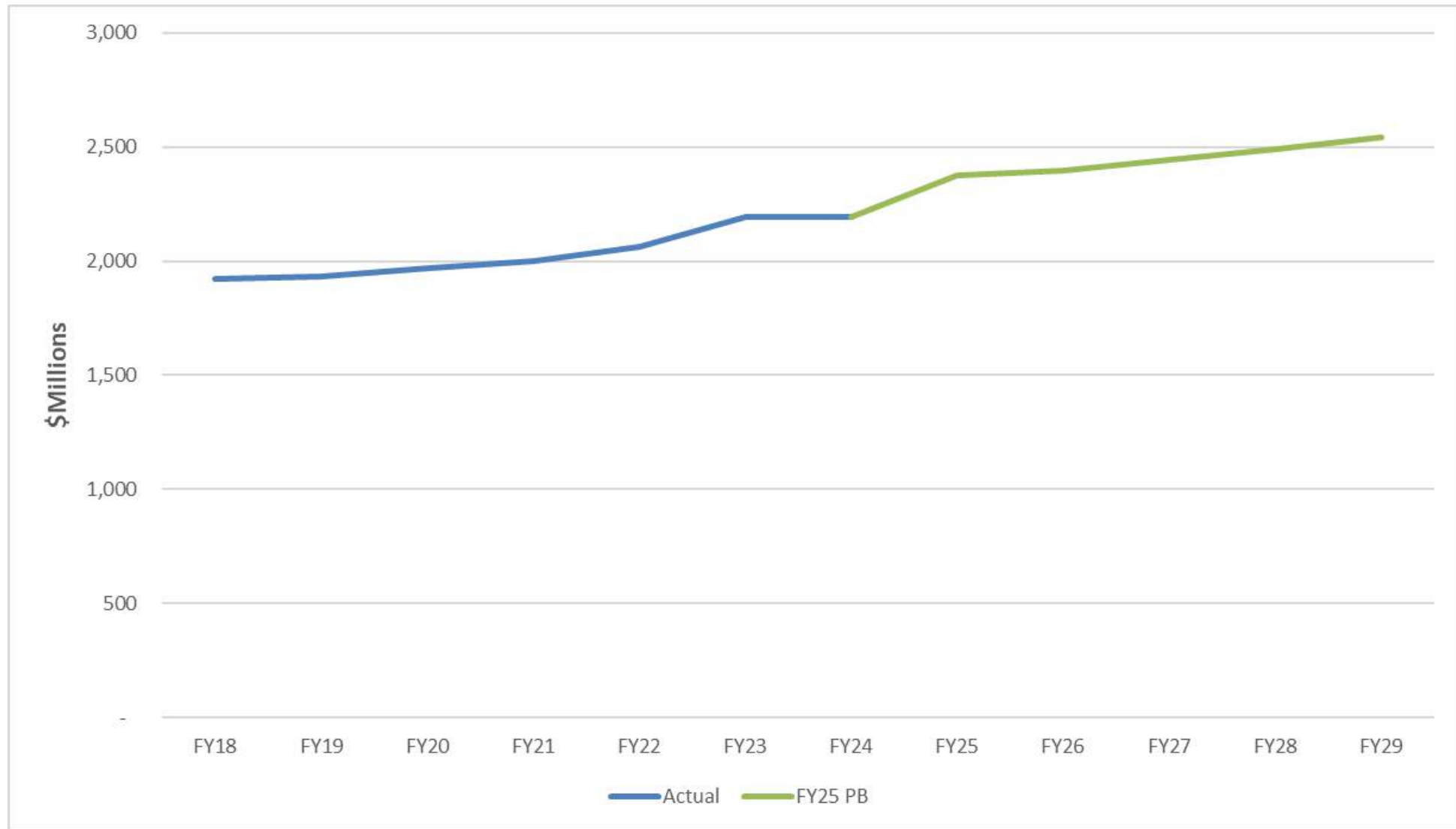
National Aeronautics and  
Space Administration



# MAP Program Update

David B. Considine  
Earth Science Division, NASA Headquarters  
March 20, 2024

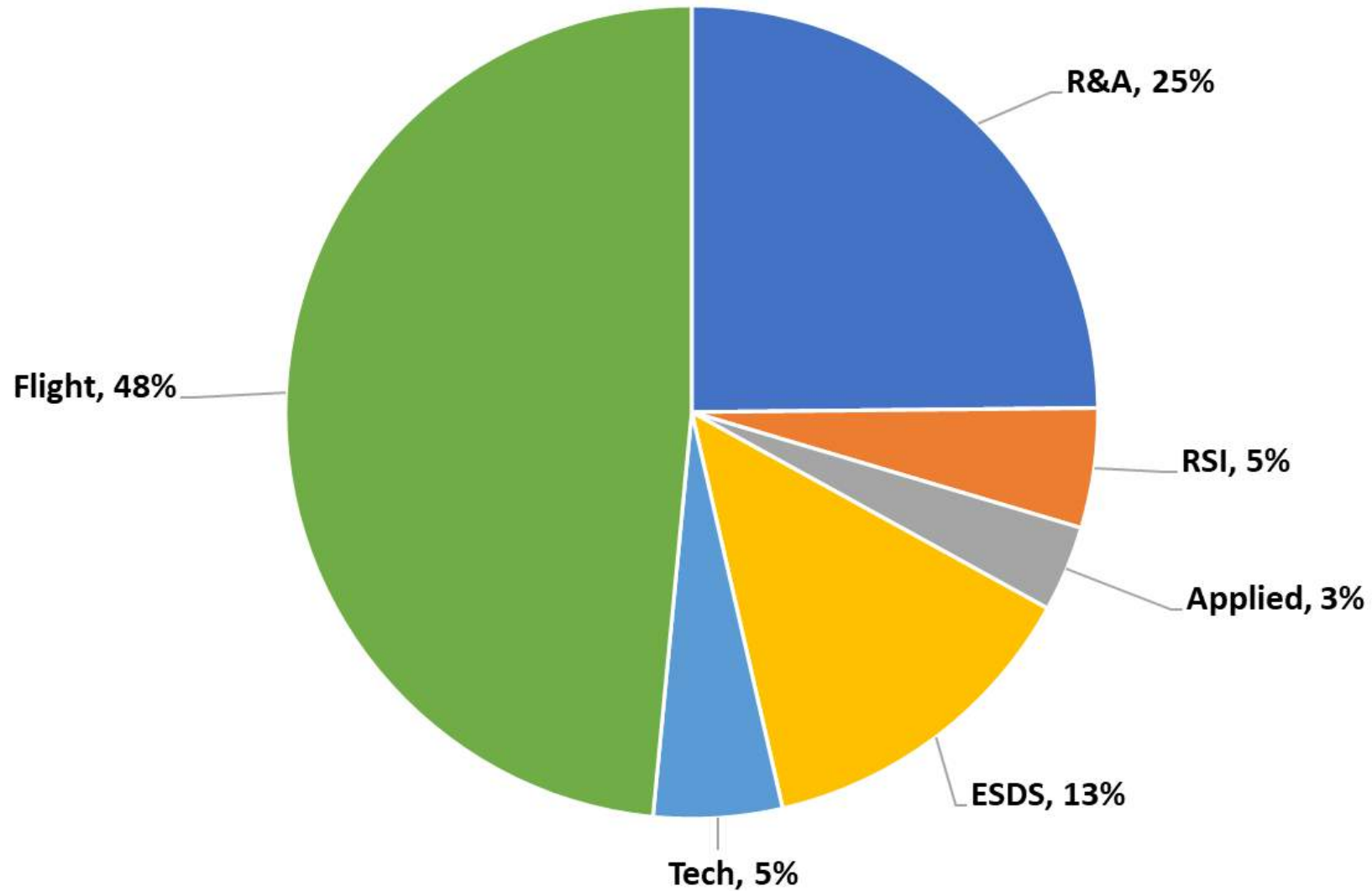
# ESD Budget In Context



# FY25 ESD President's Budget Request by Program

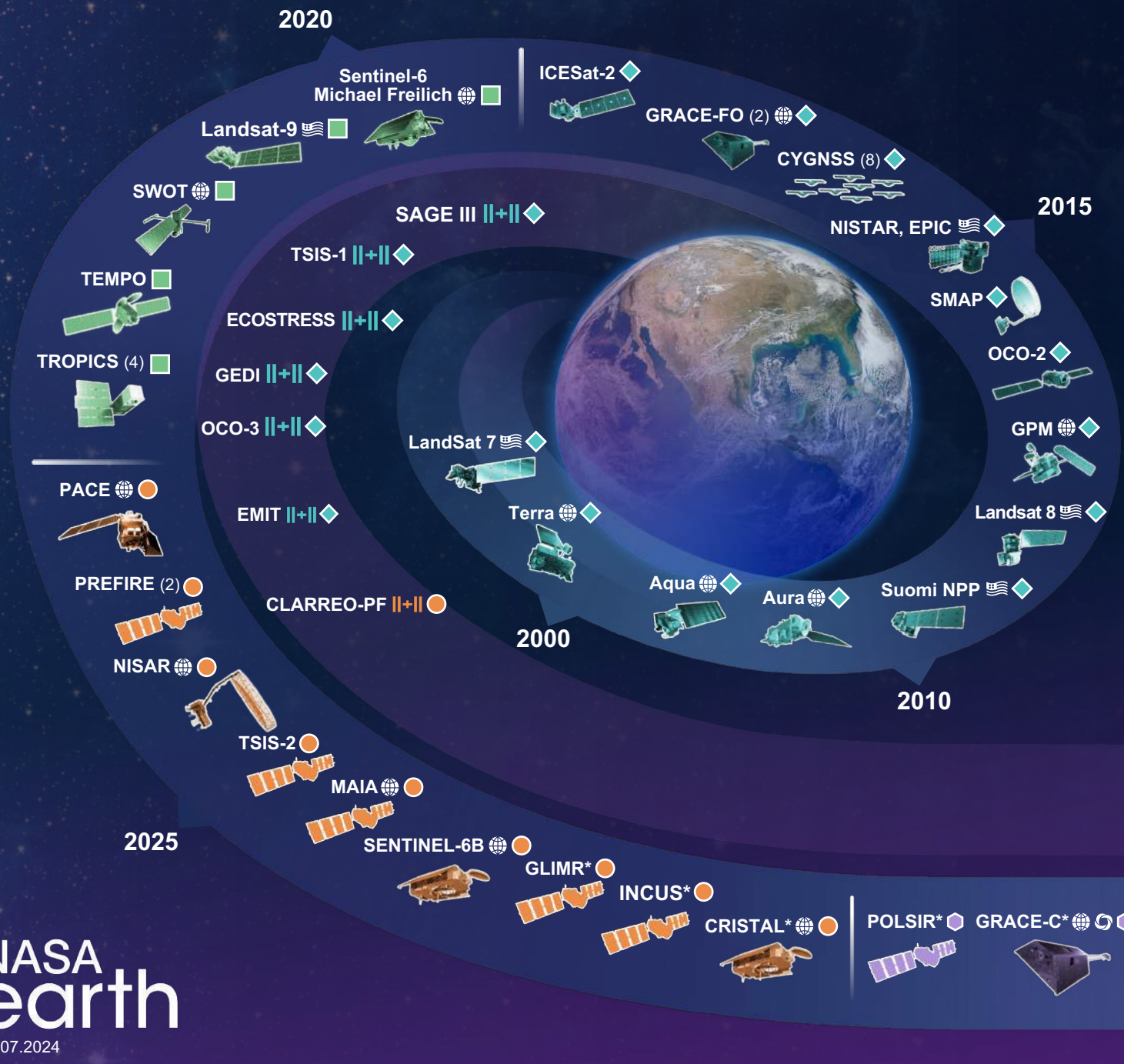
(\$K)	Actual	Plan	Request	Outyears			
	FY23	FY24	FY25	FY26	FY27	FY28	FY29
<b>Total Earth Science</b>	<b>2,194,000</b>	<b>2,251,635</b>	<b>2,378,651</b>	<b>2,396,300</b>	<b>2,446,100</b>	<b>2,489,700</b>	<b>2,543,400</b>
Earth Systematic Missions	914,956	771,336	854,432	868,694	888,155	869,878	757,827
Earth System Science Pathfinder	232,116	245,474	251,726	245,979	202,066	224,988	308,934
Earth System Explorers	2,459	22,064	19,581	58,969	99,491	130,638	194,710
Earth Science Data Systems	365,087	392,341	263,236	257,569	268,340	269,798	276,340
Earth Science Technology	102,181	105,349	147,248	109,392	110,596	111,812	113,040
Applied Sciences	75,205	87,560	68,591	73,344	73,470	75,804	75,901
Earth Science Research	501,996	627,511	606,152	608,425	627,558	628,848	637,188
Responsive Science Initiatives	-	-	167,685	173,928	176,424	177,934	179,460

# FY25 ESD President's Budget Request Program Balance





# EARTH FLEET



Key		Invest/CubeSats	
International Partners		NACHOS 2022	
U.S. Partner		CTIM 2022	
ISS Instrument		NACHOS-2 2022	
JPSS Instrument		MURI-FD 2023	
Cubesat		SNOOPI* 2024	
Launch Date TBD		HYTI* 2024	
Earth System Observatory Mission		ARGOS* 2024	
(Pre) Formulation		JPSS Instruments	
Implementation		OMPS-LIMB 2022	
Operating		LIBERA 2027	
Extended		OMPS-LIMB 2027	
		OMPS-LIMB 2032	

## ISS INSTRUMENTS



## MISSIONS

# Earth Science to Action Strategy

Earth Science to Action



## Virtuous Cycle

- User needs inform next iteration of programs, missions and initiatives

## Public Understanding & Exchange

- Put more scientific understanding into public sphere
- Deliver applied science to users
- Participate in multi-way info exchange
- Use input to inform subsequent work

## Solutions & Societal Value

- Offer models, scientific findings and info through Open-Source Science principles
- Support climate services
- Provide science applications and tools to inform decisions

## Earth System Science & Applied Research

- Grow scientific understanding of Earth's systems
- Develop predictive modeling for science applications and tools to mitigate, adapt and respond to climate change

## Foundational Knowledge, Technology, Missions & Data

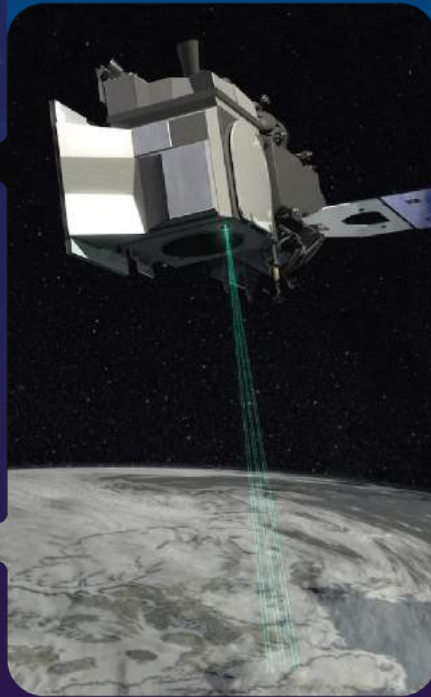
- Technology innovation
- Earth observations missions
- Data collected from space, air and ground

# Earth Science: who's included

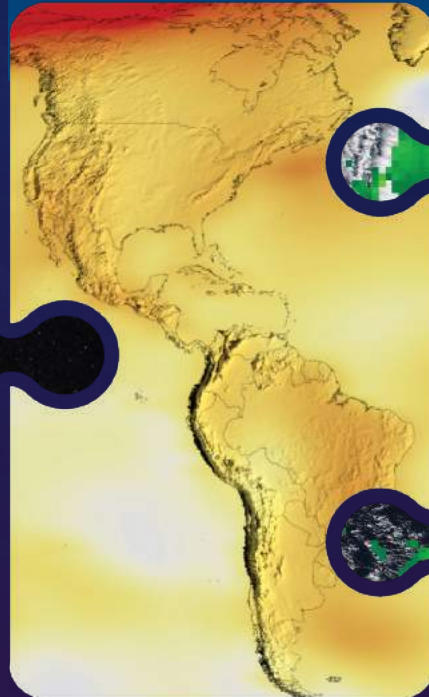
Technology



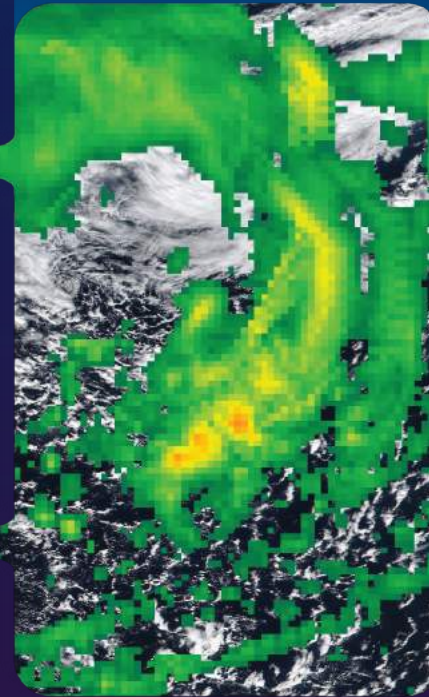
Flight



Research and Analysis



Data and Compute



Earth Action



# Earth Science to Action: the basics

The Earth Science to Action strategy is the Earth Science Division's 2024-2034 strategic plan. This strategy is our plan of action designed to achieve our vision, mission and strategic goals.

- ESD's response to 2017 Decadal Survey and other national priorities
- Drives next iteration of programs, missions, initiatives
- Informs budget approach
- Informs employee performance expectations

The background of the slide is a satellite image of Earth's surface, showing a mix of blue oceans, green and brown landmasses, and white clouds. The NASA Earth logo is overlaid on the right side of the image. The word "NASA" is in a white, sans-serif font, and the word "earth" is in a larger, white, lowercase sans-serif font.

NASA  
earth



# STRATEGIC GOAL

Within a decade, we will advance and integrate Earth science knowledge to empower humanity to create a more resilient world.





# Objective 1

Holistically observe, monitor and understand the Earth system

**Key Result 1.1:** The most advanced Earth observing system in the world

**Key Result 1.2:** Cutting-edge technology

**Key Result 1.3:** Integrated and trusted Earth system data

**Key Result 1.4:** Scientific breakthroughs to better understand Earth



## Objective 2

○ Deliver trusted information to drive Earth resilience activities

**Key Result 2.1:** Models that capture the intricacies of the Earth system

**Key Result 2.2:** Co-designed solutions and tools to support users

**Key Result 2.3:** Science-based information we can trust and act on

**Key Result 2.4:** Promotion of Earth information as a national asset



# NASA Modeling, Analysis and Prediction Program

## Goals:

- Develop an understanding of the Earth as a complete, dynamic system.
- Understand/quantify changes in Earth system, sources of change, and future change
- Represent understanding in:
  - Comprehensive, representative models of the Earth system
  - Model/observation syntheses of the Earth system
- Utilize models and syntheses to improve mitigation and adaptation to global change

## Strategies:

- Pursue Earth system science
- Focus on observation-driven modeling
- Focus on Earth system characterization, diagnosis, prediction, and observing system design
- Focus on utilization for provision of societal benefits



## ROSES 24 MAP Solicitation

- Released on February 14, 2024
- Expected funding: ~7M
- Estimated number of new awards: ~30
- Maximum duration of awards: 4 years
- Optional Notice of Intent: 5/31/24
- Proposal submission due date: 7/01/24



## ROSES 24 MAP Research Themes

- **Clouds in Earth System Models**

- Proposals addressing cloud processes and their representation in ESMs
  - Proper representation and understanding of features that determine climate sensitivity
  - Precipitation processes – phase, distribution, frequency, intensity
  - Role of clouds in driving atmospheric circulation patterns
  - Impact of atmospheric transport on clouds

- **Extremes in the Earth System**

- Evaluation of ESM representation of extremes
- Interconnections which lead to extreme behavior
- Model improvements of key underlying processes.
- Impacts of extremes on natural and human systems
- Exposure and vulnerability to extremes

- **Constituents in the Climate System (aerosols and chemical species)**

- Role of climate change on constituent distributions in the atmosphere, and vice versa
- Air quality processes and prediction (effects of wildfires on atmospheric composition and radiation, GHGs, ozone)
- Emissions parameterizations – particularly interactive parameterizations



## ROSES 24 MAP Research Themes

- **Coupling in the Earth System**

- Proposals that accurately capture the couplings between the components of the Earth system
  - Land/vegetation/atmosphere coupling
  - Ocean biogeochemistry coupling with the atmosphere
  - Coupling between natural and human systems in the context of ESMs

- **Assimilation**

- Proposals that address outstanding assimilation issues
- Methods for assimilating new NASA observations not currently assimilated in NASA data assimilation systems (e.g. PACE)
- Focus on coupled data assimilation and reanalysis techniques
  - Weak vs strongly coupled, minimization of reanalysis artifacts (observing system changes), bias correction, improved consistency/integration of reanalysis systems, uncertainty quantification, improved predictive skill at longer than weather time scales

- **Earth System Modeling for Earth Science to Action**

- Categories include agriculture, air quality, disasters, wildfire, water issues
- Hazard, exposure, vulnerability studies
- ES2A-specific parameterizations in ESMs
- Downscaling methods
- Diagnostics



## ROSES 24 MAP Programmatic Priorities

- Proposals that:
  - Characterize and help reduce uncertainties in models and products
  - Extend the range of model/product validity
  - Address ESD research and applications questions/Align with stated themes
  - Enable independent community validation/characterization of core MAP elements
- Observations and their utilization are required
- ML/AI-based approaches are welcomed
  - Faster, more accurate parameterizations
  - Model emulators
  - Interpretable ML/AI
  - Physics/Aware ML/AI

### Open Science and Data Management Plan

All proposals must include an Open Science and Data Management Plan (OSDMP)

- Up to two pages in length, after references/citations for Science/Technical/Management section
- How will publications, data, and software be made available?
  - All data and information acquired and data products produced must be made publicly available
  - [ROSES Open Science and Data Management Plan FAQ](https://science.nasa.gov/researchers/sara/faqs/osdmp) - see <https://science.nasa.gov/researchers/sara/faqs/osdmp>