

National Aeronautics and
Space Administration

NASA earth

**Earth Science Division Community
Forum | March 13, 2024**

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Click “CC” in the bottom left corner for Closed Captions



Enter your questions into the Q&A section



This webinar will be recorded

The NASA Earth logo, featuring the words 'NASA' and 'earth' in white, stacked vertically. The background is a colorful, textured image of Earth's surface, showing various geographical features like mountains and oceans in shades of blue, green, and orange.

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Today's Topics

- Budget
 - Context + Priorities
 - Highlights
 - Program Details

-
- Accomplishments + Milestones
 - ESD Highlights

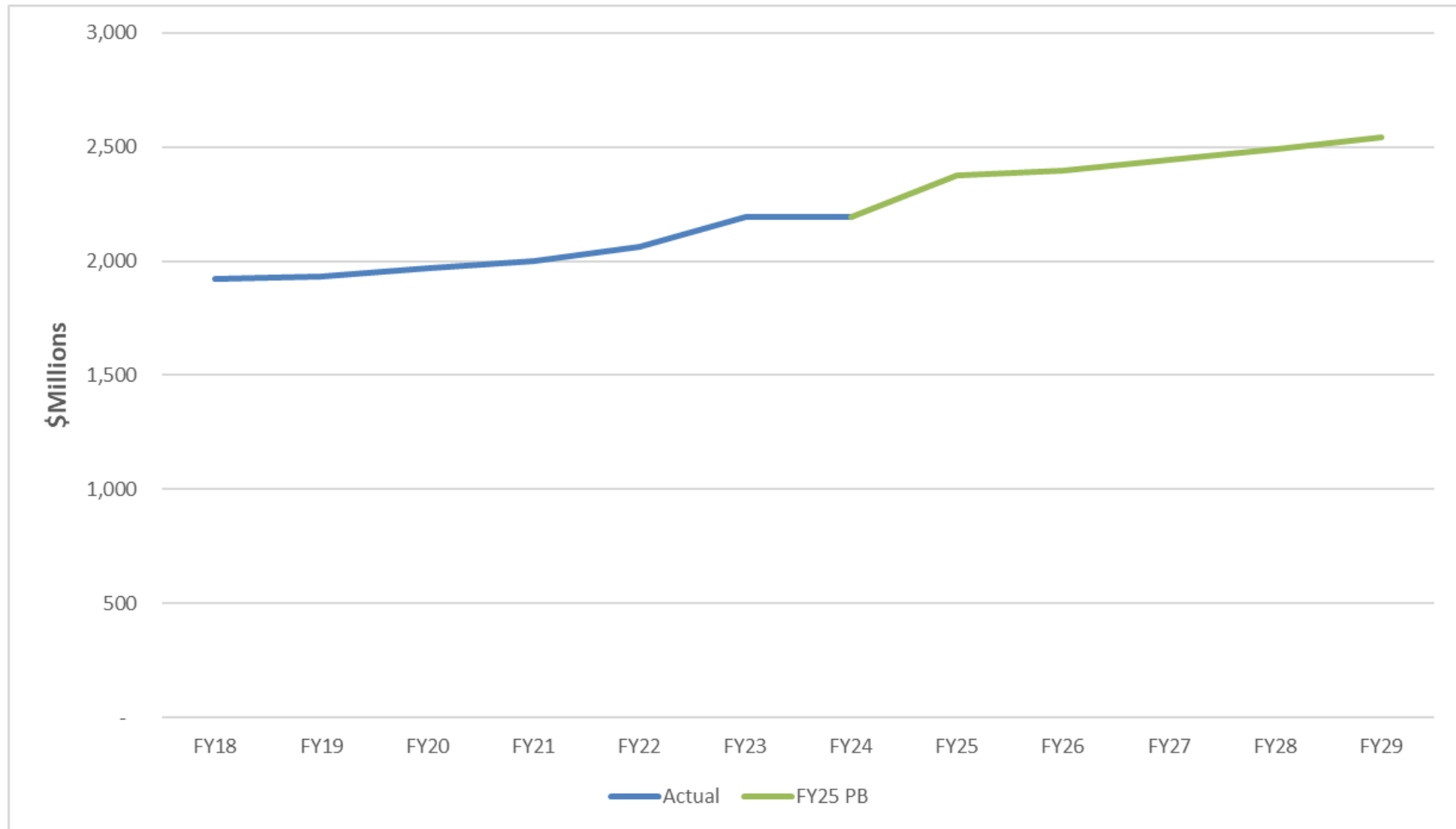
The background of the slide is a satellite image of a river delta, showing intricate patterns of water and land. The colors range from light tan and beige to deep greens and blues. The NASA Earth logo is overlaid on the right side of the image. The word "NASA" is in a bold, white, sans-serif font, and "earth" is in a larger, white, lowercase sans-serif font.

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An aerial photograph of a river delta, showing a complex network of channels and distributaries. The land is a mix of green and brown, indicating vegetation and bare earth. A large, semi-transparent blue overlay covers the left and top portions of the image, partially obscuring the river channels. The text 'Budget: Context + Priorities' is centered in a white font on a dark blue horizontal band.

Budget: Context + Priorities

ESD Budget In Context



Earth Science Budget Priorities

Explore/Innovate/Partner/Inspire

Achieve high priority science objectives within a cost constrained environment through the integrated missions of the **Earth System Observatory** and provide continuity and advancement of the capabilities of economically critical **Landsat Next**.

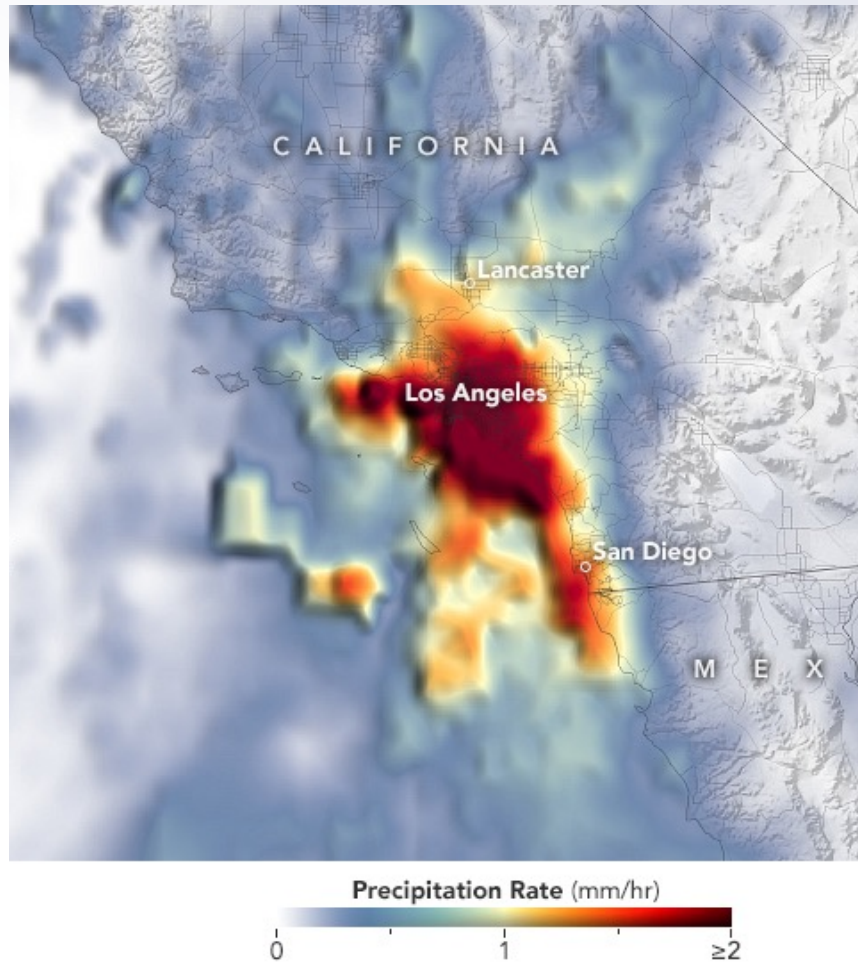
Adapt implementation of **Earth Venture** and **Senior Review** process to ensure their sustainability, in response to National Academies review

Consolidate our strategy to improve the impact and management of our support of information about changes in the Earth system across Federal and international partners through the realigned **Responsive Science Initiatives** program.

An aerial photograph of a river delta, likely the Colorado River, showing a complex network of channels and distributaries. The land is a mix of green and brownish-yellow, indicating vegetation and arid terrain. A large, semi-transparent blue overlay covers the left and top-left portions of the image, framing the central text.

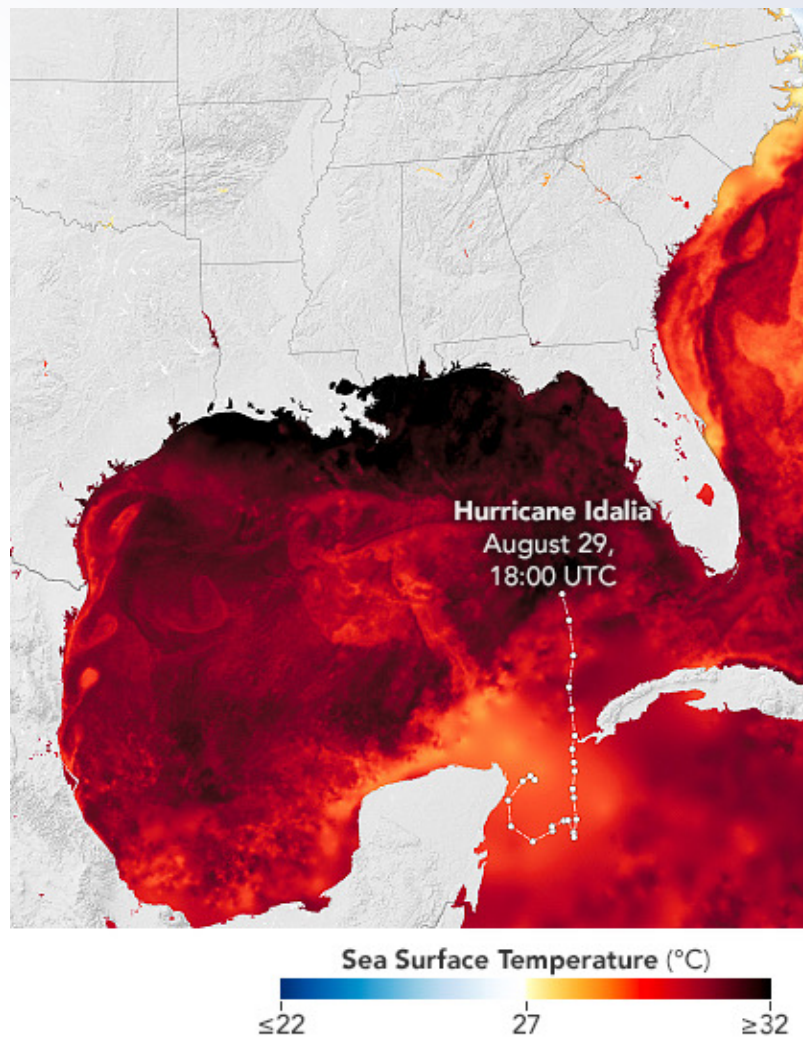
Budget Highlights

Earth Science Budget Highlights



CAPTION – A potent storm drenches California on February, 5-6 2024, IMERG precipitation data as part of NASA-JAXA Global Precipitation Mission.

- **Earth System Observatory** used a “Decouple, Partner, and Compete” approach to follow Decadal Survey recommendations and significantly reduce cost and optimize scope while remaining on track to deliver new knowledge
 - **Atmospheric Science** restructure from Atmospheric Observing System (AOS) architecture—still includes high priority observables and multiple missions; now mix of directed and at least one competed mission, with decoupled schedules
 - **Precipitation Measurement Mission** in partnership with Japan
 - **Surface Biology and Geology** directed instrument contribution to an international mission plus a mission with industry partners, with decoupled schedules
 - **Surface Deformation and Change** no additional study, NISAR mission meets the observable
- **Landsat Next** proceeds to instrument procurement and supports agriculture, resource management
- **Venture & Explorer** cadence; better supports proposal development pacing



CAPTION – Hurricane Idalia track on August 29, 2023 superimposed over Multiscale Ultrahigh Resolution sea surface temperatures modeled from Terra MODIS data.

Earth Science Budget Highlights

- Extension of **Terra/Aqua/Aura** to end of life, all missions in extended operations through 2026, senior review wedge in 2027 bounds future cost growth
- Supports critical **research, applications, data and technology** for mission schedules
- Consolidation of some mission science teams and discipline research areas for greater synergies across fields
- **Responsive Science Initiatives Program** realigns elements of research, tech, applied, and data programs and will focus on areas of national importance to work with interagency partners and provide products, information, and research with significant societal value
- Includes a sustained budget increase for **Interagency Satellite Observation Needs** (responsive to Satellite Needs Working Group)

Doubles the investment in **Geodesy** infrastructure, supporting NASA, civil space and national security needs for accurate Earth positioning

- New content in Earth Science Technology to begin developing the first space-borne **quantum gravity gradiometer (QGG)**.

The National Academies of
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CONSENSUS STUDY REPORT

THRIVING ON OUR CHANGING PLANET

A Decadal Strategy for Earth Observation from Space



Key National Academies Guidance

**Increase the impact of Earth science
for the response to climate change**

“Pursue increasingly ambitious objectives and innovative solutions that enhance and accelerate the science/applications value of space-based Earth observations and analysis to the nation and the world in a way that delivers great value, even when resources are constrained, and ensures that further investment will pay substantial dividends.”

- Thriving on Our Changing Planet: A Decadal Survey for Earth Observations from Space, 2017

Responsive Science Initiatives: Implementing Earth Science to Action Strategy



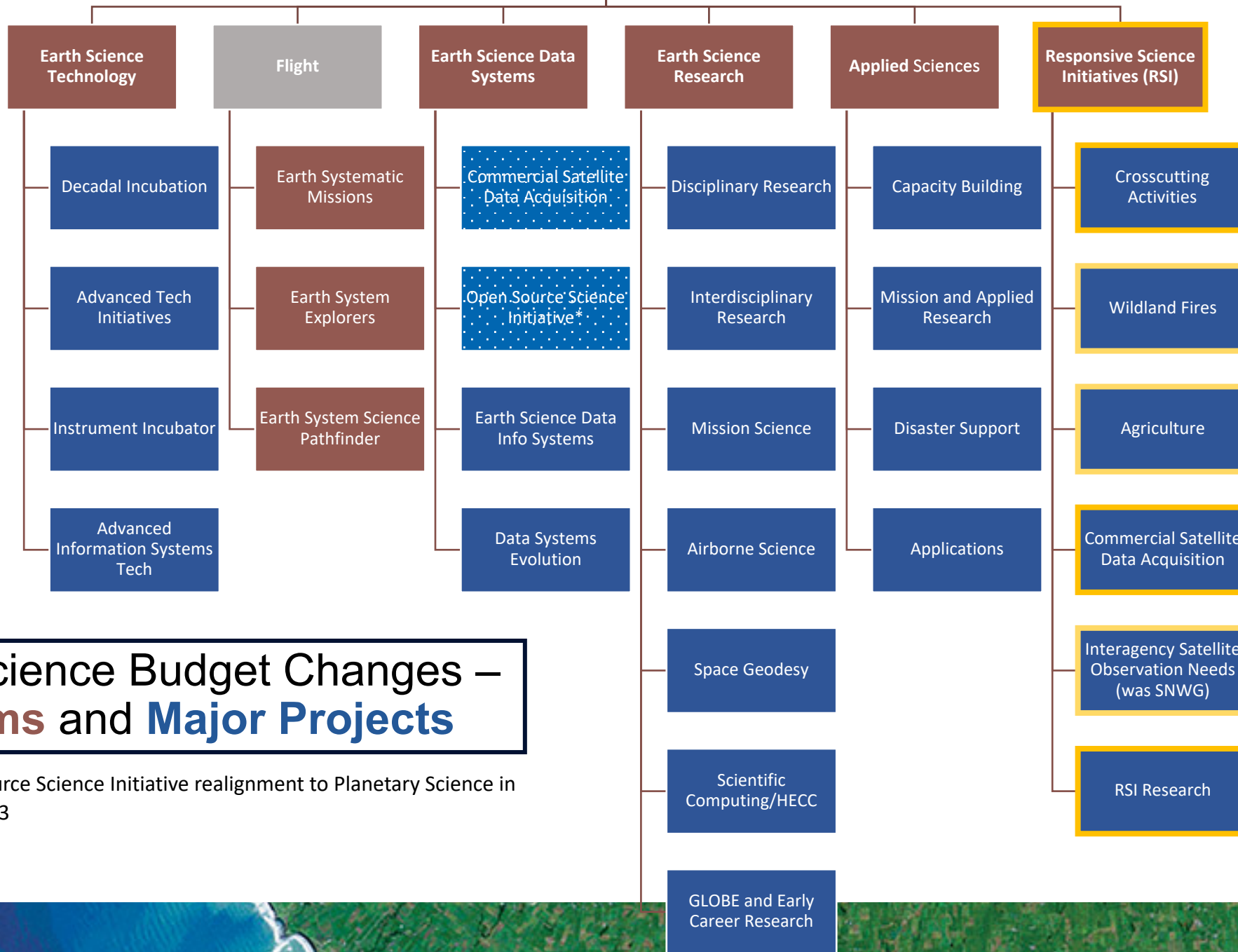
New program proposed in the FY25 President's Budget, created by realignment.

RSI will connect user needs with NASA remote sensing observations and Earth system science to provide trusted information that supports decision making and benefits society.

- Crosscutting approach encouraging synergies amongst projects – scaling successful demonstrations
- User-focused identification of needs (other Federal Agencies, international agencies, state, local and tribal governments)
- Adapted to the complex management requirements of multi-agency and multi-stakeholder projects
- No impact or reduction in current competed R&A, Applied Sciences or Technology

Six major projects:

- Crosscutting Activities
- Interagency Satellite Observation Needs (ISON)
- Agriculture
- Wildland Fires
- Responsive Science Initiatives Research (RSI-R)
- Commercial Satellite Data Acquisition (CSDA)



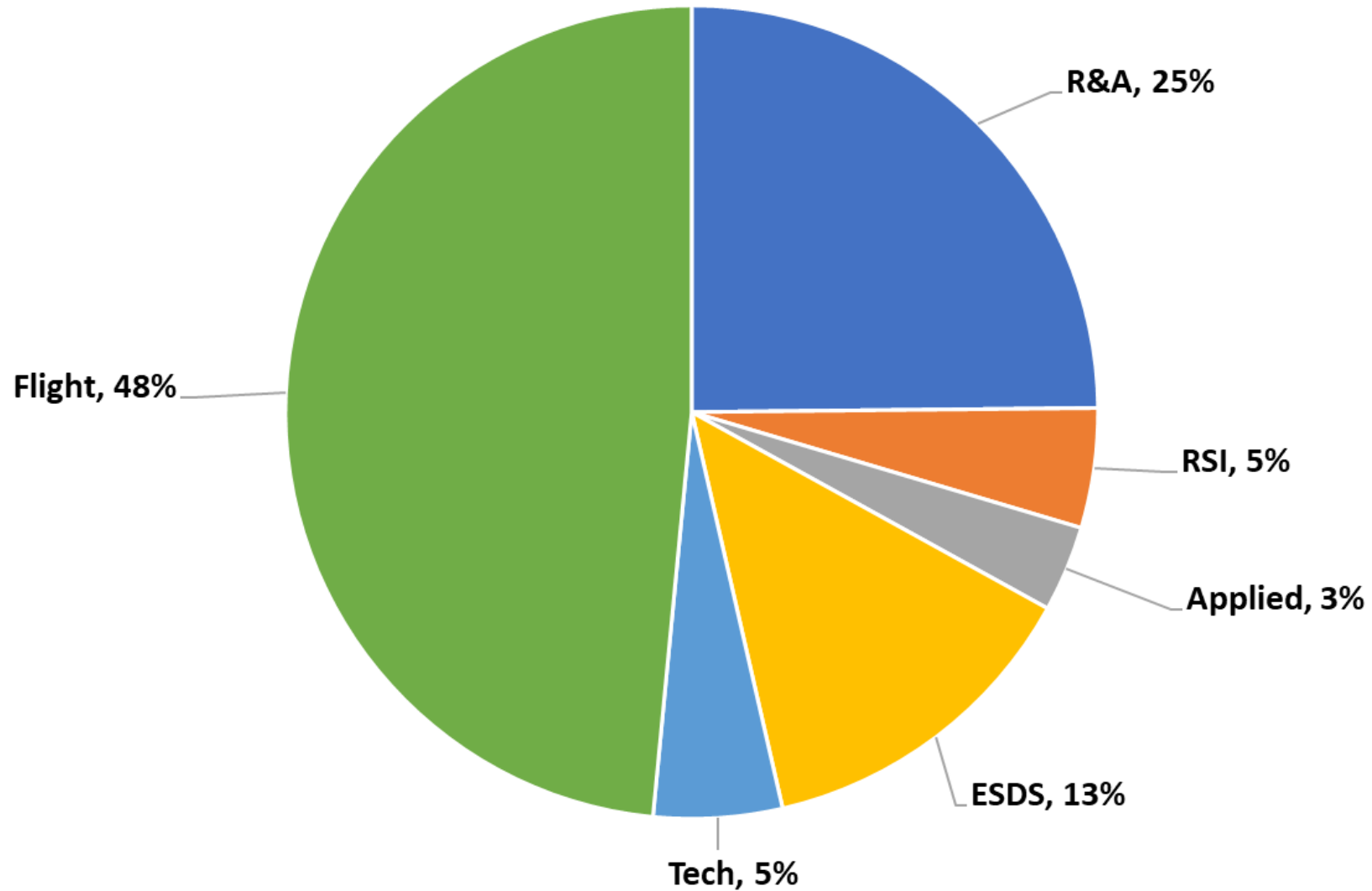
Earth Science Budget Changes – Programs and Major Projects

*Note Open Source Science Initiative realignment to Planetary Science in FY23 Ops Plan #3

FY25 ESD President's Budget Request by Program

(\$K)	Actual	Plan	Request	Outyears			
	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Total Earth Science	2,194,000	2,251,635	2,378,651	2,396,300	2,446,100	2,489,700	2,543,400
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



An aerial photograph of a river delta, likely the Colorado River, showing a complex network of channels and distributaries. The image is overlaid with semi-transparent blue and green shapes, possibly representing water flow or land use. The text "Budget: Program Details" is centered in a dark blue banner across the middle of the image.

Budget: Program Details

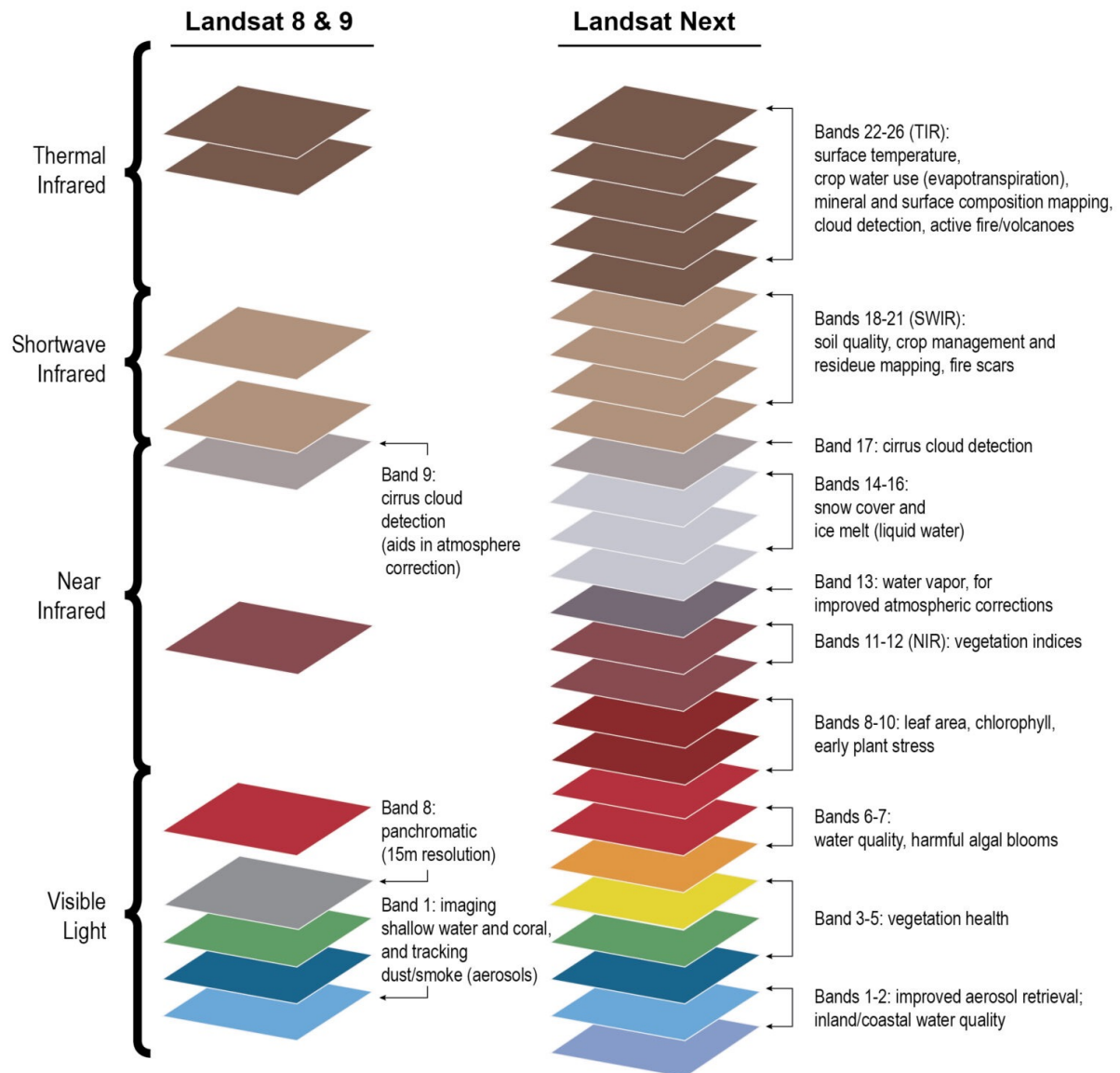
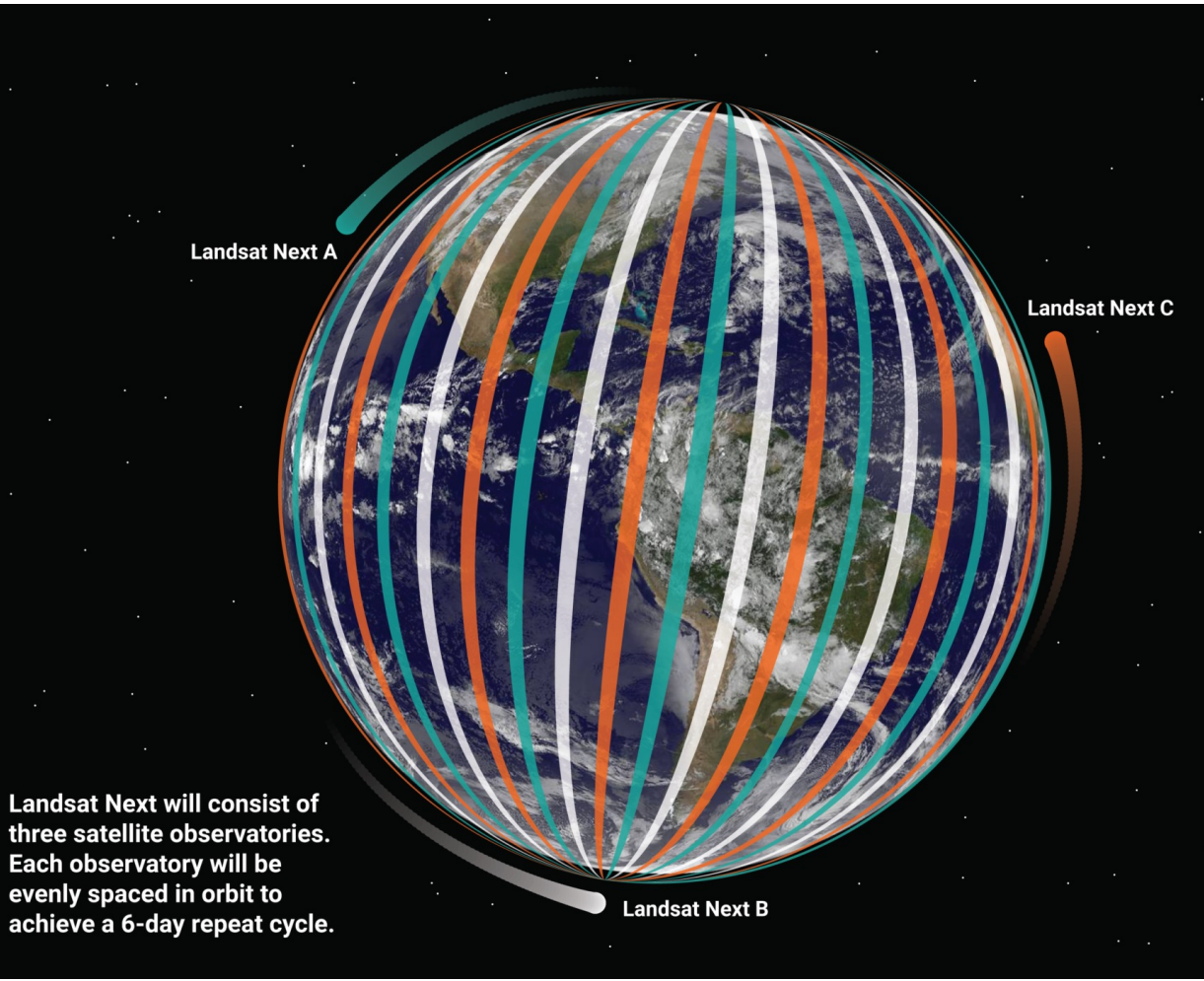
Landsat Next



Proceeds to instrument procurement, ensuring continuity of measurements that support agriculture, resource management, and critical information needs across the federal government

Spectral Comparison of Landsat 8/9 and Landsat Next

Increased spectral coverage with Landsat Next will support emerging applications



Decadal Missions

- **Implements the 2017 Decadal Survey** for Earth System Observatory, Landsat-Next, Earth System Explorers and Earth Venture, Preserves the Earth System Observatory, selects the best science for each observable, and emphasizes competition in austere budget environments
- **Venture & Explorer**, establishes **PoSIR** from EVI-6; **integrated cadence** better supports proposal development pacing over the budget window, 1-year delay of **EVS-5**
- **Earth System Observatory** with a “**Decouple, Partner, and Compete**” approach to reduce cost and scope without canceling a major mission area in Earth System Science, each mission schedule decoupled
 - **GRACE-C** (formerly **Mass Change**), no change (launch 2029)
 - **SBG-TIR** retained as an instrument contributed to a partner mission, successor to ECOSTRESS, is a far better imager for addressing heat stress than Landsat capabilities, leverages cost effective partnering, and will be launched years before Landsat Next (launch 2028)
 - **SBG-VSWIR** delayed by 2.5 years (launch now NET 2032), successor to EMIT with 20x coverage including methane, critical minerals
 - **AOS-Sky** restructured for ACCP designated observables collected by a mix of competed and directed missions with decoupled schedules.
 - Details of plans for competition will be released in a community announcement as soon as possible after the PBR (launch 2030-2031)
 - **AOS-Storm** replaced with launch to meet partner commitments JAXA **Precipitation Measurement Mission (PMM)** and a co-launch of a second CNES-built radiometer on a GSFC-integrated platform (launch 2029)

Changes in the AOS Planned Acquisition under the Decouple, Partner and Compete Approach

Tightly Coupled Architecture

Larger integrated missions

AOS-Sky backscatter lidar

AOS-Storm precipitation radar & radiometer

AOS-Storm backscatter lidar

AOS-Sky cloud/convection radar



Decoupled Architecture

Missions fly when they are ready

New multi-purpose lidar mission (Italy, US)

Precipitation Measurement Mission; multi-partner contributions (Japan, France, US)

Removed from inclined mission

Competed mission, final selection of the best science approach that fits the budget

Directed and partnered missions:

- Solidifies and expands international partnerships
- Expect industry procurement of most instruments

EARTH SYSTEM OBSERVATORY

INTERCONNECTED CORE MISSIONS

SURFACE BIOLOGY AND GEOLOGY

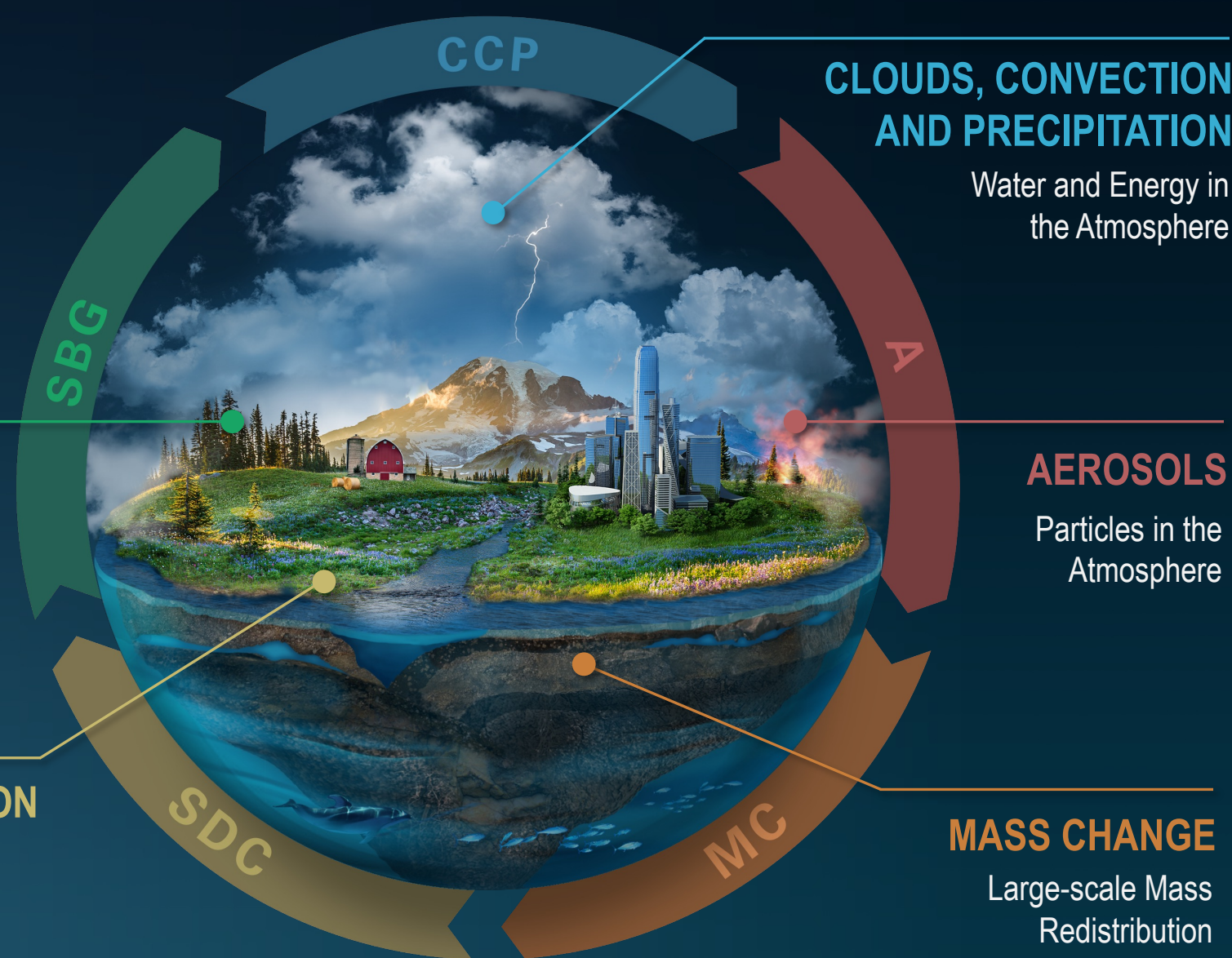
Earth Surface & Ecosystems

SBG-TIR
SBG-VSWIR

SURFACE DEFORMATION AND CHANGE

Earth Surface Dynamics

Met by **NISAR** launch in 2024



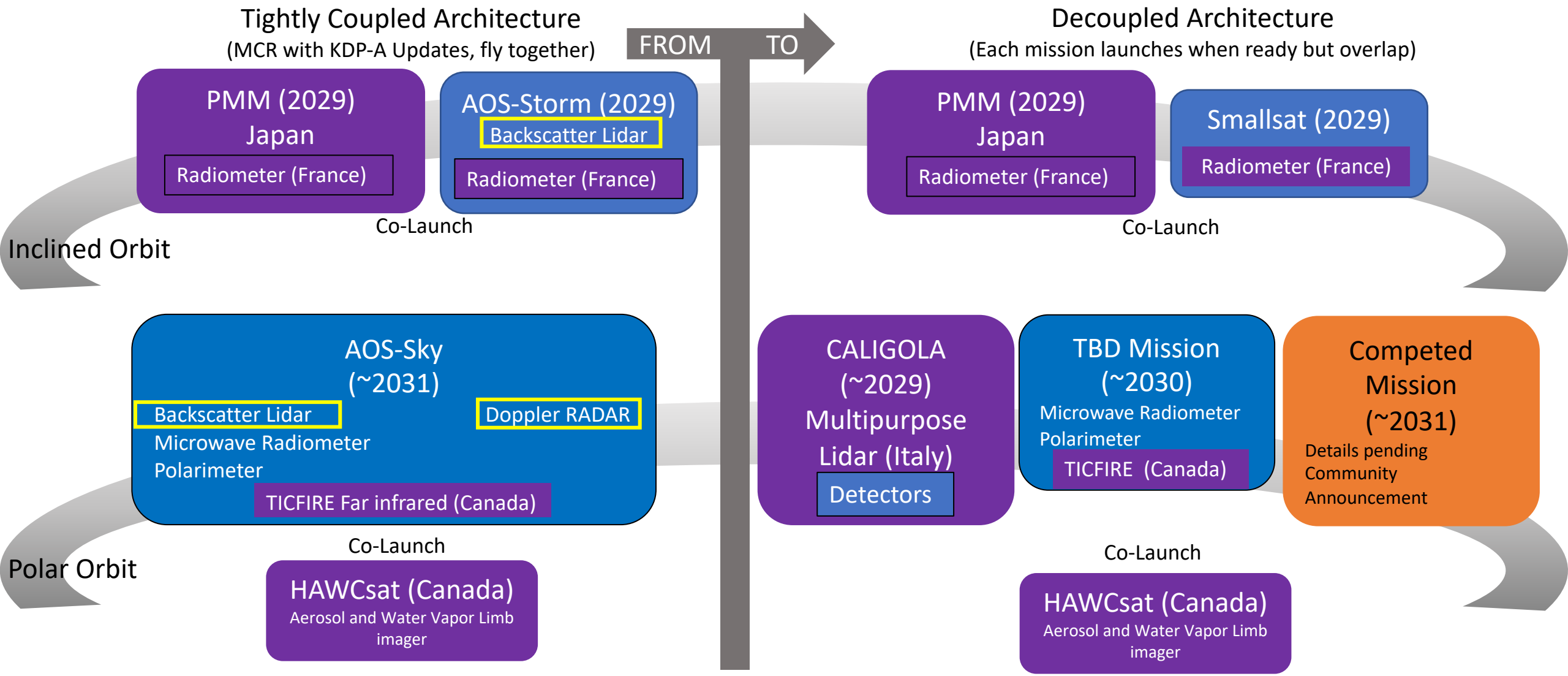
ATMOSPHERIC SCIENCE MISSIONS

PMM
Competed Mission
Directed Mission
Partner Missions

Observables now in Mission Formulation

GRACE-C

Changes in the AOS Planned Acquisition under the Decouple, Partner and Compete Approach



PMM (2029)
Japan
Radiometer (France)

AOS-Sky (2029)
Backscatter Lidar
Radiometer (France)

PMM (2029)
Japan
Radiometer (France)

Smallsat (2029)
Radiometer (France)

AOS-Sky (~2031)
Backscatter Lidar
Microwave Radiometer
Polarimeter
TICFIRE Far infrared (Canada)

HAWCsat (Canada)
Aerosol and Water Vapor Limb imager

CALIGOLA (~2029)
Multipurpose Lidar (Italy)
Detectors

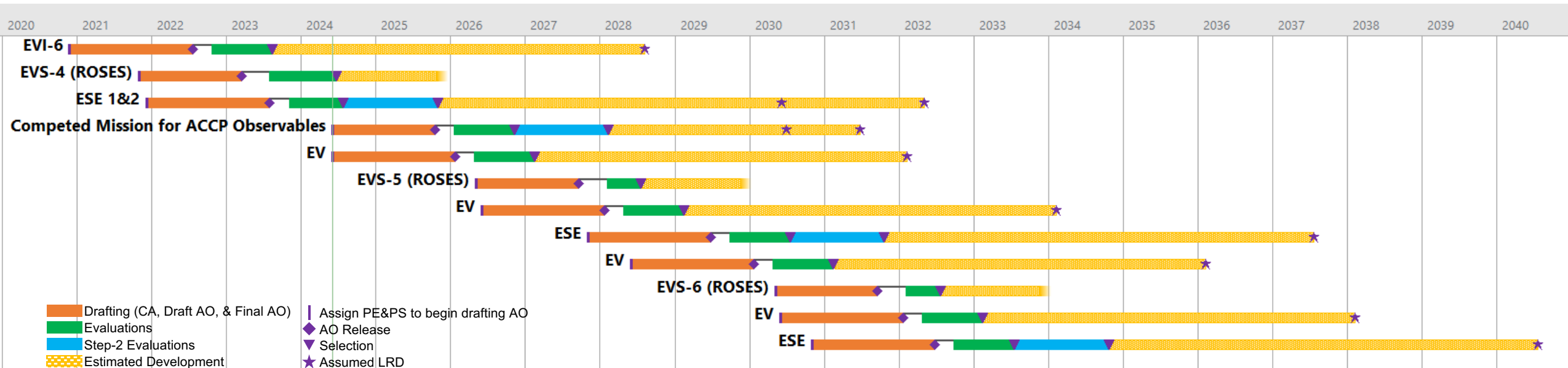
TBD Mission (~2030)
Microwave Radiometer
Polarimeter
TICFIRE (Canada)

HAWCsat (Canada)
Aerosol and Water Vapor Limb imager

Competed Mission (~2031)
Details pending Community Announcement

Updated Explorers and Venture Integrated Cadence

- Many of the same PIs/institutions are competing for Venture and Explorers AOs, pacing them in an integrated way helps with HQ, center and university proposal workloads
- EV experience indicates that it is extremely difficult to compete and select every 18 months.
- Consistent with NASEM recommendation to “consider discontinuing the distinction between EV Mission and EV Instrument proposals”



Earth Science Flight Opportunities (FY25)

Mission	Mission Type	Release	Selection	Major Milestone
EVS-1 (EV-1) (AirMoss, ATTREX, CARVE, DISCOVER-AQ, HS3)	5 Suborbital Airborne Campaigns	2009	2010	Completed KDP-F
EVM-1 (CYGNSS)	Class D SmallSat Constellation	2011	2012	Launched December 2016
EVI-1 (TEMPO)	Class C Geostationary Hosted Instrument	2012	2012	Launched April 2023
EVI-2 (ECOSTRESS & GEDI)	Class C & Class D ISS-hosted Instruments	2013	2014	Launched June & December 2018
EVS-2 (ACT-America, ATOM, NAAMES, ORACLES, OMG, CORAL)	6 Suborbital Airborne Campaigns	2013	2014	Completed KDP-F
EVI-3 (MAIA & TROPICS)	Class C LEO Hosted Instrument & Class D CubeSat Constellation	2015	2016	MAIA Delivery 2022; TROPICS Launched in May 2023
EVM-2 (GeoCarb)	Class D Geostationary Hosted Instrument	2015	2016	Cancelled
EVI-4 (EMIT & PREFIRE)	Class C ISS-hosted Instrument & Class D Twin CubeSats	2016	2018	EMIT launched to ISS July 2022; PREFIRE delivery NLT 2023
EVS-3 (ACTIVATE, DCOTSS, IMPACTS, Delta-X, SMODE)	5 Suborbital Airborne Campaigns	2017	2018	All in post-deployment phase.
EVI-5 (GLIMR)	Class C Geostationary Hosted Instrument	2018	2019	Delivery NLT 2024
EVC-1 (Liberia)	Class C JPSS-Hosted Radiation Budget Instrument	2018	2020	Delivery NLT 2025
EVM-3 (INCUS)	Class D SmallSats	2020	2021	Launch ~2027
EVI-6 (PoISIR)	Class D CubeSats	2022	2023	Delivery NLT 2027
ESE	Explorer Mission	2023	2025	Launch ~2030 & ~2032
EVS-4	Suborbital Airborne Campaigns	2023	2024	N/A
EVX*	Orbital instrument, mission, or continuity	2026	2027	Launch ~2032
EVS-5	Suborbital Airborne Campaigns	2027	2028	N/A
EVX*	Orbital instrument, mission, or continuity	2028	2029	Launch ~2034
ESE	Explorer Mission	2029	2031	Launch ~2037
EVX*	Orbital instrument, mission, or continuity	2030	2031	Launch ~2036

EVS
Sustained sub-orbital investigations (~4 years)

EVX
Small-size orbital instruments and missions (~2 years)

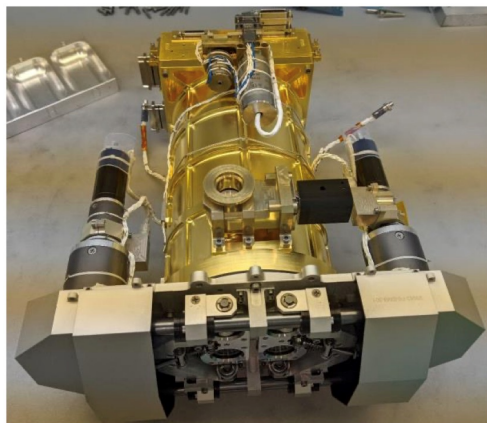
ESE
Medium-size orbital instruments and missions (~3 years)

Open solicitation/In review
Completed solicitation

*EVX Mission type will be dictated by PoR needs when AO is released.

This fits into ESD strategy for portfolio flexibility and resilience

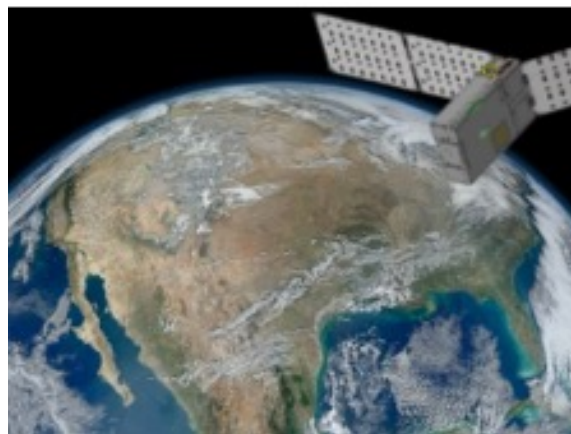
Upcoming Earth Science Launches 2024-2025



TSIS-2

TSIS-2 Total Irradiance Monitor (TIM) Sensor

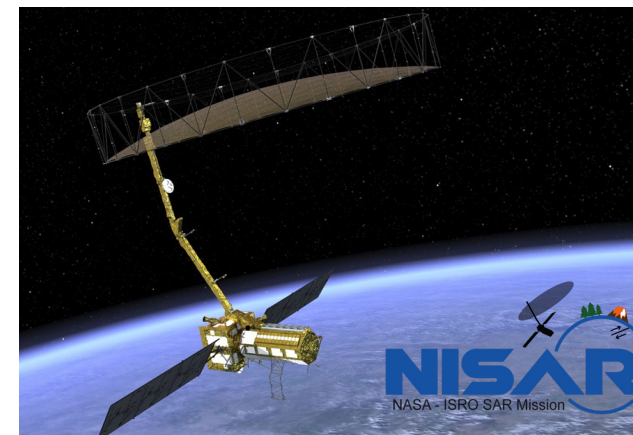
Measures total irradiance and spectral irradiance from the sun, adding to four decades of continuous data records of the Sun's energy input to Earth.



PREFIRE

Polar Radiant Energy in the Far-InfraRed Experiment

Close a gap in our understanding of how much of Earth's heat is lost to space, especially from the Arctic and Antarctica.



NISAR

NASA-Indian Space Research Organization Synthetic Aperture Radar Mission

Information about the Earth surface and ice masses driving changes in natural hazards, sea level rise, biomass, and groundwater



Local students participate in an Earth Information Center (EIC) student engagement event, Friday, June 23, 2023.



Amazonian leaders visit NASA's Earth Information Center, Friday, Nov. 17, 2023

Sharing our work by

- Putting more scientific understanding into public sphere
- Delivering applied science to users
- Participating in multi-way info exchange
- Using input to inform subsequent work



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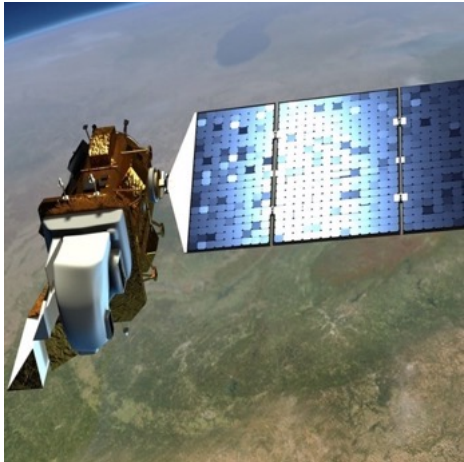
science.nasa.gov/earth

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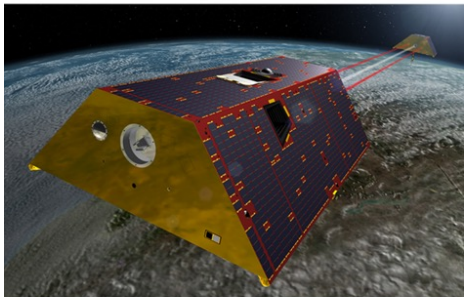
An aerial photograph of a river delta, showing a complex network of channels and distributaries. The land is green and brown, indicating vegetation and soil. A large, semi-transparent blue shape is overlaid on the top-left portion of the image.

Accomplishments and Milestones

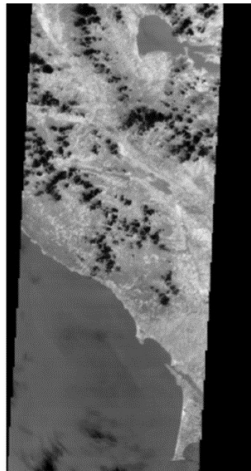
Recent Accomplishments



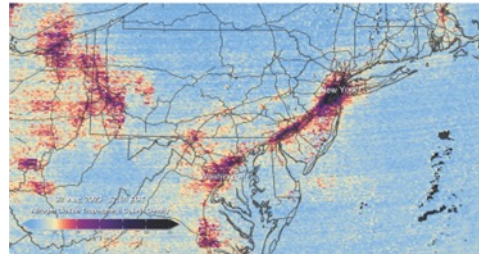
Landsat satellites provide data crucial for modern maps used by consumers, researchers and governments worldwide.



Artist's rendition of the two GRACE-C satellites in orbit around Earth. Separated by over 100 miles, they work together to build gravity maps and track water storage.



The ESTP's Multiband Uncooled Radiometer Imager (MURI) instrument was on 1/3/23, as one of several hosted payloads within the Loft Orbital YAM5 SmallSat..



This image shows nitrogen dioxide levels over the DC/Philadelphia/New York region at 12:14 p.m. on August 2, 2023, as measured by TEMPO for hourly air quality at the neighborhood scale.

- **GRACE-C** advanced into Preliminary Design and Technology Completion Activities phase (Phase B)
 - Ensures continuity of measurement of gravimetry and global water storage
- Released final **Earth System Explorers** Opportunity (AO) in FY23.
 - Received proposal responses in Q4 FY23.
 - Two-step selection process for first ESE launch NLT spring 2030.
- **Landsat Next** mission successfully passed KDP-A
 - Constellation of land imaging satellites ensuring continuity of measurements that support agriculture, resource management, and critical information needs across the federal government.
 - Partnership with US Geological Survey
- Launched **PACE** aboard a SpaceX Falcon 9 rocket on Feb. 8, 2024.
 - Studies microscopic life in the oceans and microscopic particles in the atmosphere with applications for water quality, ocean productivity and air quality.
- Launched **TEMPO** instrument on April 7, 2023, on Intelsat 40E.
 - Now in operations
 - Provides unprecedented resolution of monitoring major air pollutants, down to four square miles. It will improve life on Earth through understanding temporal patterns in air quality.
- **Multiband Uncooled Radiometer Imager (MURI)** instrument hosted payloads within the Loft Orbital YAM5 SmallSat. MURI is testing a new two-band longwave infrared (10.8um and 12.0um) radiometric imager that does not require a bulky, heavy cryogenic cooler.

Planned Milestones FY24-25

- **Earth Venture Suborbital -4** selections in 2024
- **PREFIRE** launch readiness in 2024
- **Earth System Explorer** selections for competitive Phase A studies in FY24. Final mission selections will be in Q4 FY25
- **NISAR** continues integration with the launch vehicle provided by ISRO to prepare for launch in CY24. NISAR will complete commissioning and in-orbit-checkout and begin prime operations thereafter.
- **MAIA** instrument delivered to ASI in FY24 for integration onto the satellite—mission links air quality and health with epidemiology and will launch in 2025
- The **Wildland Fires** team will host science-user group workshops to co-develop Wildland fire management solutions that leverage NASA data, models, and related technologies.
- The **Responsive Science Research** project will begin in FY25 and release its first solicitation.
- In FY25, the **ISON** project anticipates continued operation and implementation of the successful solutions identified in the Interagency Satellite Needs Working Group 2016-2020 assessment cycles with several activities becoming operational.
- Within the Agriculture project, **NASA Harvest** will complete a standing system and methodology in FY25, based on the Ukraine food supply assessment processes, for Rapid Action for Agriculture Policy.
- Launch the **Disaster Response Coordination System (DRCS)**, which will formalize NASA's approach for leveraging the best available science, technology, and expertise in support of domestic and international disaster response.
- Within the **Capacity Building** project, FY 2025 will complete the first full year of operations for the **SERVIR** Central America hub.



ESD Highlights: Foundational Knowledge, Technology, Missions & Data



Quantum Pathway Institute for Earth Science Applications



A kickoff meeting was held in early February for the Quantum Pathways Institute, a five-year, \$15M, STMD-funded and ESTO-managed effort to advance quantum sensing technologies, particularly for mass change.

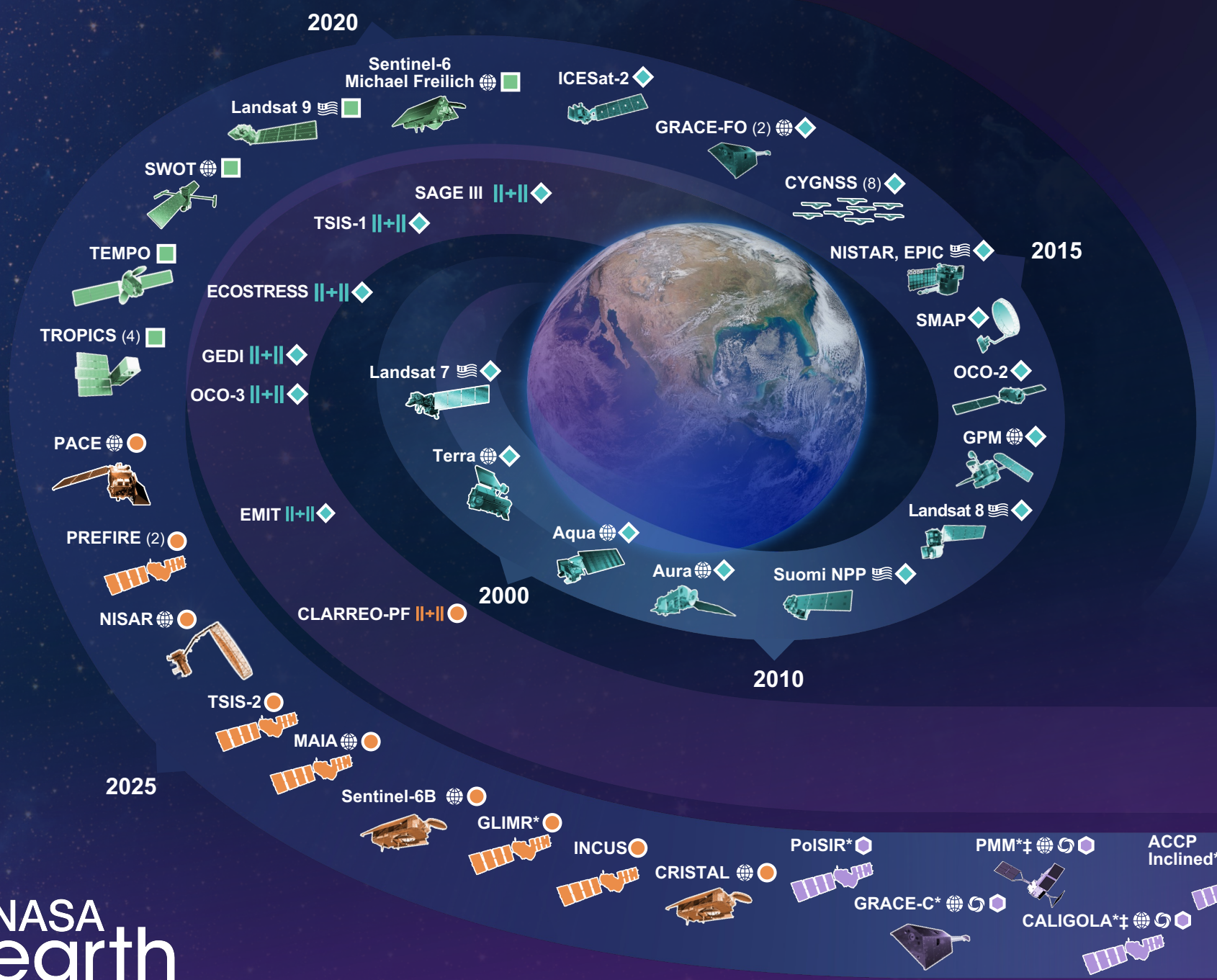
Quantum sensors use quantum physics principles to potentially collect more precise data and enable unprecedented science measurements. While the basic principals have been conceptually demonstrated, the institute will work to advance the physics underlying quantum sensors, design how these sensors could be built for space missions, and investigate how mission design and systems engineering would need to adapt to accommodate this new technology.

University of Texas at Austin is leading the institute in partnership with University of Colorado Boulder; University of California, Santa Barbara; California Institute of Technology; and the National Institute of Standards and Technology.

For additional information, see the STMD award announcement: <https://bit.ly/486bCrm>



EARTH FLEET



Key

- International Partners
- U.S. Partner
- ISS Instrument
- JPSS Instrument
- Cubesat
- Launch Date TBD
- Earth System Observatory Mission
- Contributes to ACCP Science Goals
- (Pre) Formulation
- Implementation
- Operating
- Extended

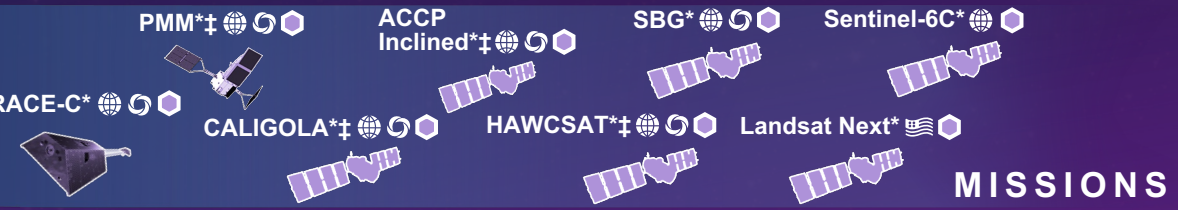
Invest/CubeSats

- NACHOS 2022
- CTIM 2022
- NACHOS-2 2022
- MURI-FD 2023
- SNOOPI* 2024
- HYTI* 2024
- ARGOS* 2024

JPSS Instruments

- OMPS-LIMB 2022
- LIBERA 2027
- OMPS-LIMB 2027
- OMPS-LIMB 2032

ISS INSTRUMENTS



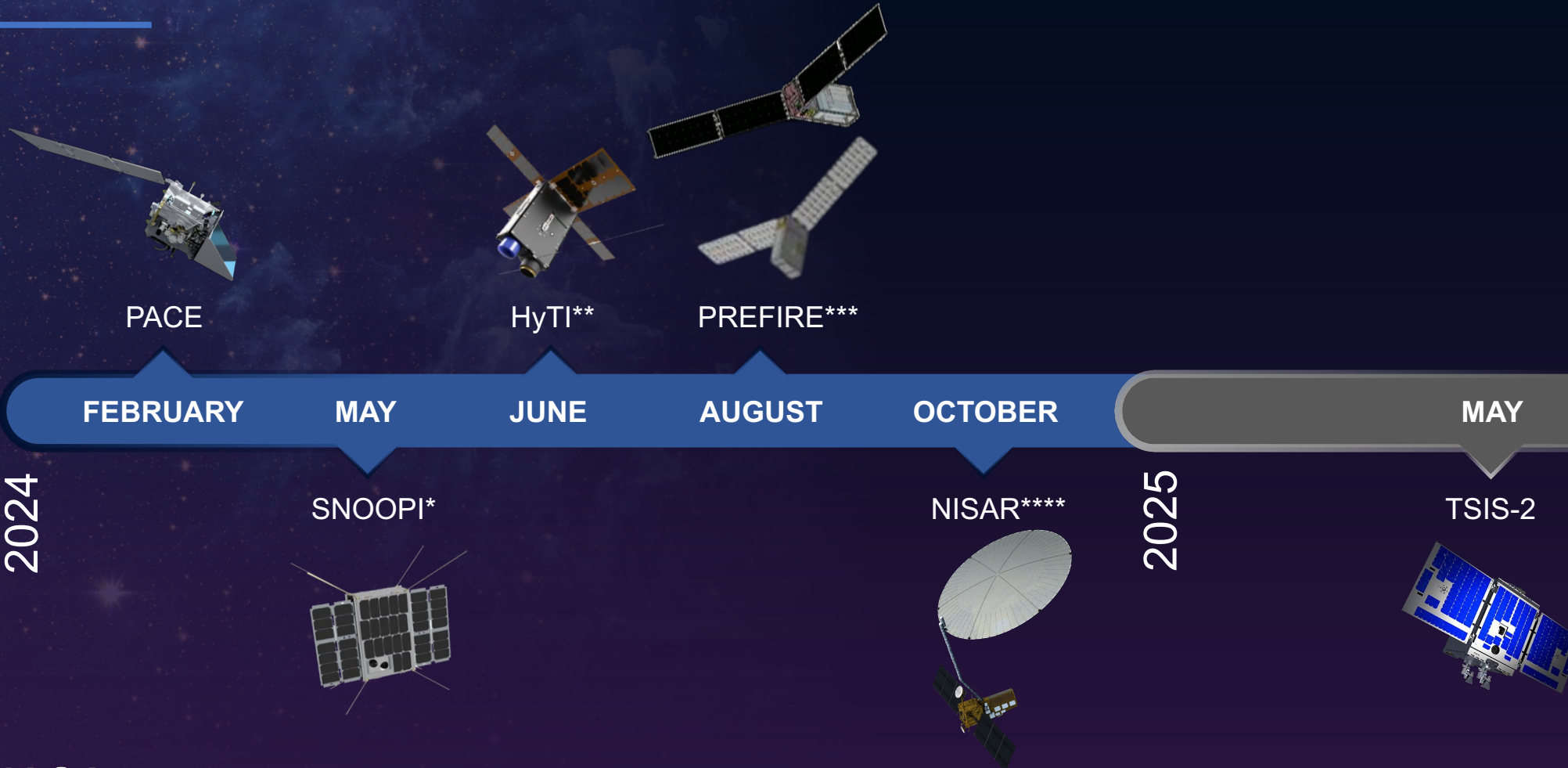
Recent and Upcoming Earth Science Launches

*Launch Date NET February 2024

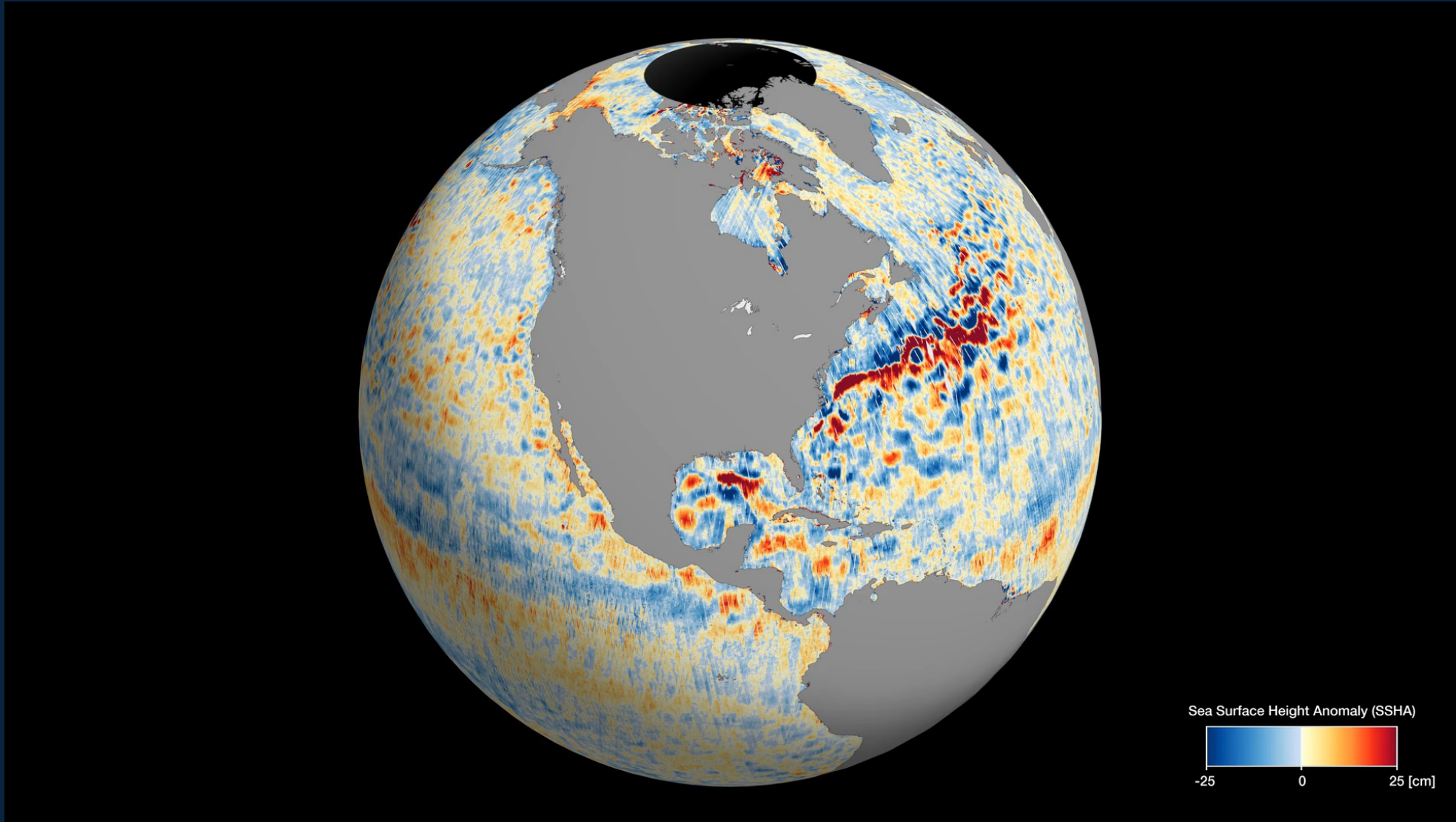
**Launch Date NET June 2024

***Agency LRD Aug 2024

****Agency LRD Oct 2024



SWOT First 21-day cycle



SWOT's first full 21-day science orbit, which it completed between July 26 and Aug. 16, 2023

PACE Launch Feb 8, 2024



NISAR

NASA-ISRO Synthetic Aperture Radar

In final phase of system integration & Test (SIT-4) at ISRO facility in Bangalore, India

Integrated instruments (L & S Band Radars) and engineering payload delivered to ISRO in March 2023

NASA and ISRO hardware integrated

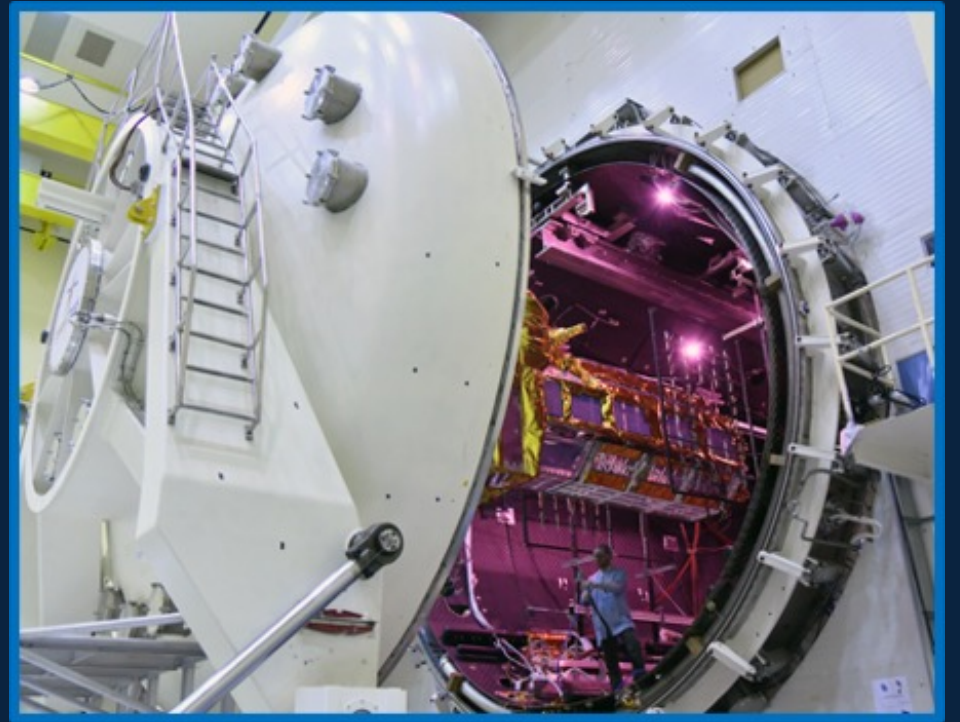
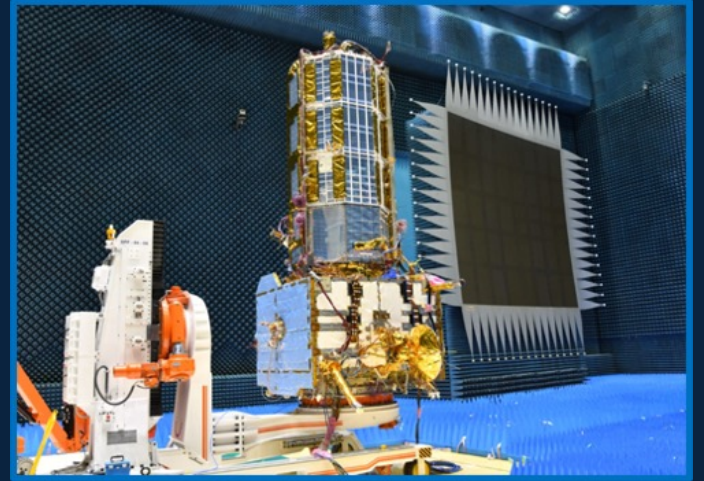
All functional tests completed



Progress to launch

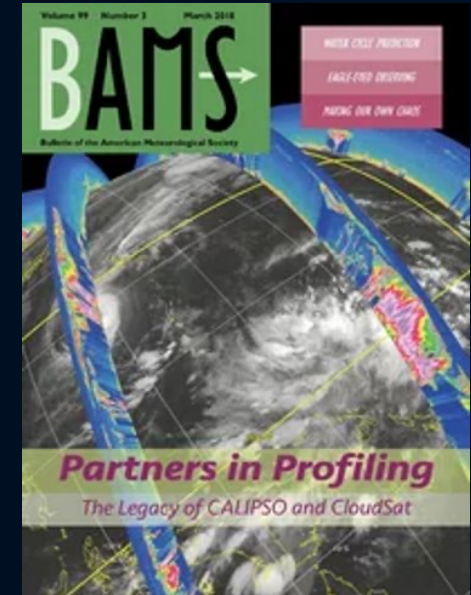
Environmental tests completed successfully with nominal system performance

Mission scenario tests completed. Data flow/communication successful.



CALIPSO and CloudSat Decommission

- Launched together in 2006, CALIPSO and CloudSat are decommissioning after successfully collecting lidar and radar observations for over 17 years.
- CloudSat ended science operations on December 20 and began conducting orbit lowering maneuvers on January 10. Final CALIPSO spacecraft passivation activities were completed on December 15.
- Designed to fly together in formation, the two missions provided first-of-its-kind combined active (lidar and radar) measurements to study the role clouds and aerosols play in regulating Earth's weather, climate, and air quality.
- The two missions revolutionized our understanding of the vertical structure of clouds and aerosols enabling a greater understanding of the larger-scale atmospheric circulation on aerosols, the hydrological cycle, the cloud-scale physics, and the formation of major storm systems.



Commercial Smallsat Data Acquisition (CSDA) Program

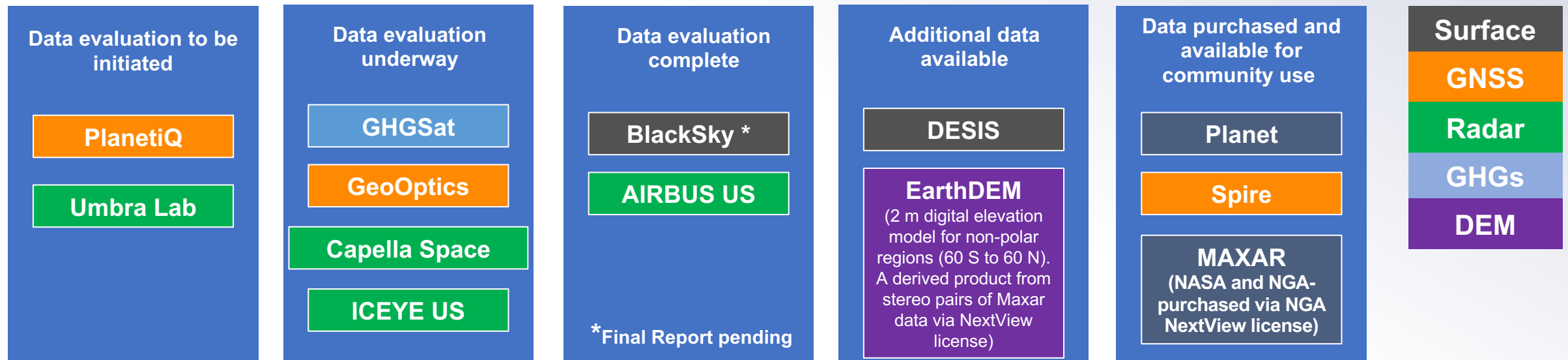
Goal: *Identify, evaluate, and acquire commercial small-satellite (smallsat) data that support NASA's Earth science research and application goals*

Highlights:

CSDA-acquired data now discoverable through Earthdata Search

Evaluations continue for BlackSky, GHGSat, GeoOptics, Capella Space, and ICEYE US. Expected completion date is end of CY 2024

Two new vendors are entering science data evaluation phase: PlanetiQ and Umbra





earthaccess

A Python Library for NASA Earthdata

earthaccess is an easy-to-use, community-driven python library with development led by NASA Openscapes

- User-friendly interface
- Customizable visualizations
- Open access for open science

```
ws.on("message", m => {
  let a = m.split(" ")
  switch(a[0]){
    case "connect":
      if(a[1]){
        if(clients.has(a[1])){
          ws.send("connected");
          ws.id = a[1];
        }else{
          ws.id = a[1]
          clients.set(a[1], {client: {position: {x: 0, y: 0, id: id}, ...
          ws.send("connected")
        }
      }else{
        let id = Math.random().toString().slice(2, 8)
        ws.id = id;
        clients.set(id, {client: {position: {x: 0, y: 0, id: id}, ...
      }
    }
  }
})
```



earthaccess can be accessed through the [github page](#) or [downloaded at Zenodo](#)

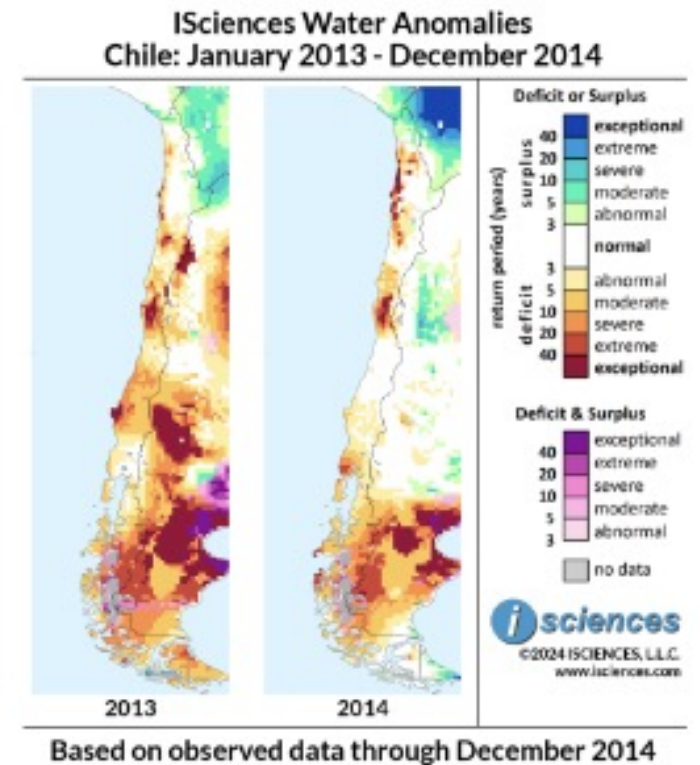
Open Science Workshop Explores Human-Environment Interactions



- In January, a workshop collaboration with NASA’s Socioeconomic Data and Applications Center and Transform to Open Science (TOPS) initiative focused on open science in studying human aspects of global environmental change.
- Participants stressed the importance of access in open science, acknowledging existing inequalities.

Key takeaways:

- Involvement of stakeholders from low-income countries in open science data is crucial.
- Creating opportunities for collaboration for data users to highlight how open science enhances decision-making.



Earth Science Data Systems Partners with IBM Research Geospatial Foundation Model Trained with HLS Data

NASA and IBM have an ongoing partnership under a Space Act Agreement to develop the first geospatial foundation model trained using Earth observation satellite imagery.

Unlike traditional text-trained models, this unique model utilizes NASA's Harmonized Landsat Sentinel-2 (HLS) data products.

Incorporating features like burn scars and flooding boundaries enhances the model's accuracy in predicting environmental events, with early testing showing a 15% improvement over previous deep learning models.

To delve deeper into how foundation models are revolutionizing remote sensing data analysis, visit the [IBM blog](#) and [IMPACT project website](#)



IMPACT project lead Rahul Ramachandran presented at the 2023 IBM Think conference alongside Sriram Raghavan, VP of IBM Research AI.



Highlights: Earth System Science & Applied Research

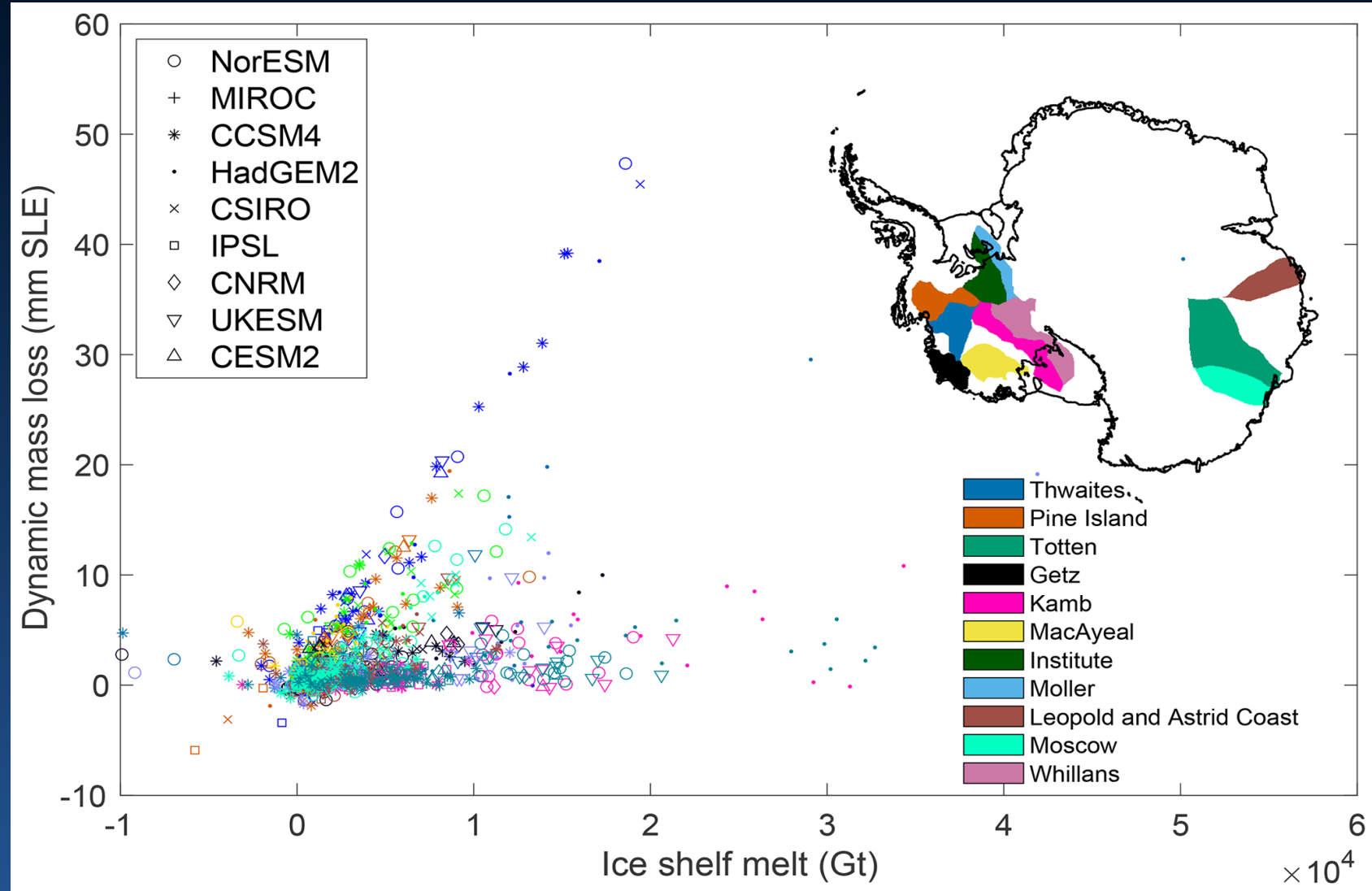


Vulnerability of Antarctic glaciers from the ISMIP6 ice sheet model ensemble

Serrousi et al. The Cryosphere,

<https://doi.org/10.5194/tc-17-5197-2023>

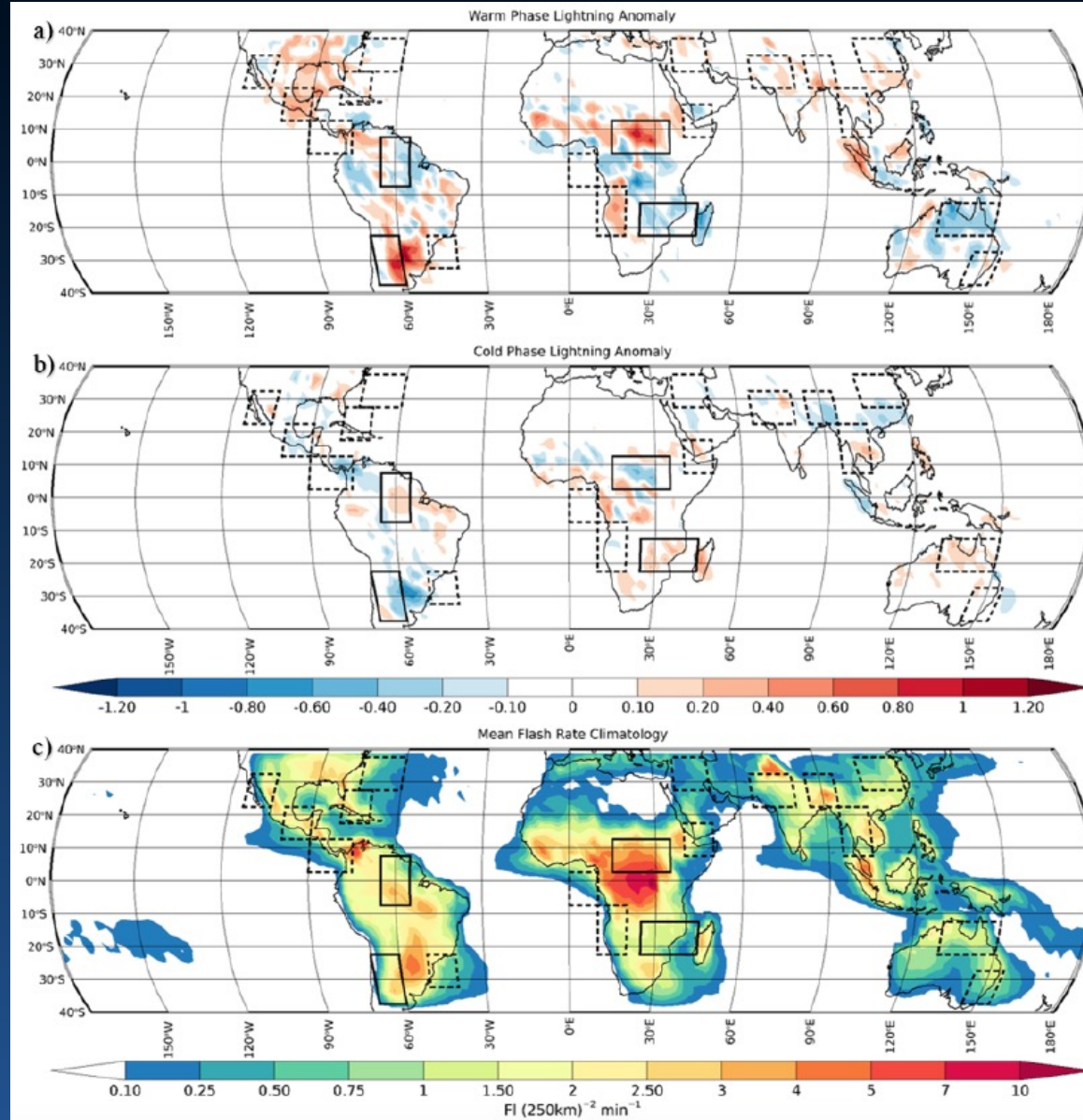
Our results show that, glaciers in both West Antarctica and East Antarctica have the potential to respond rapidly to changes in oceanic conditions and can contribute significantly to sea level change by 2100.



Lightning Patterns Related to ENSO

Clark et al., 2024. Mon. Wea. Rev., <https://doi.org/10.1175/MWR-D-23-0115.1>

Prominent and repeatable lightning anomaly patterns observed in the Lightning Imaging Sensor (LIS) dataset from the Tropical Rainfall Measuring Mission (TRMM)



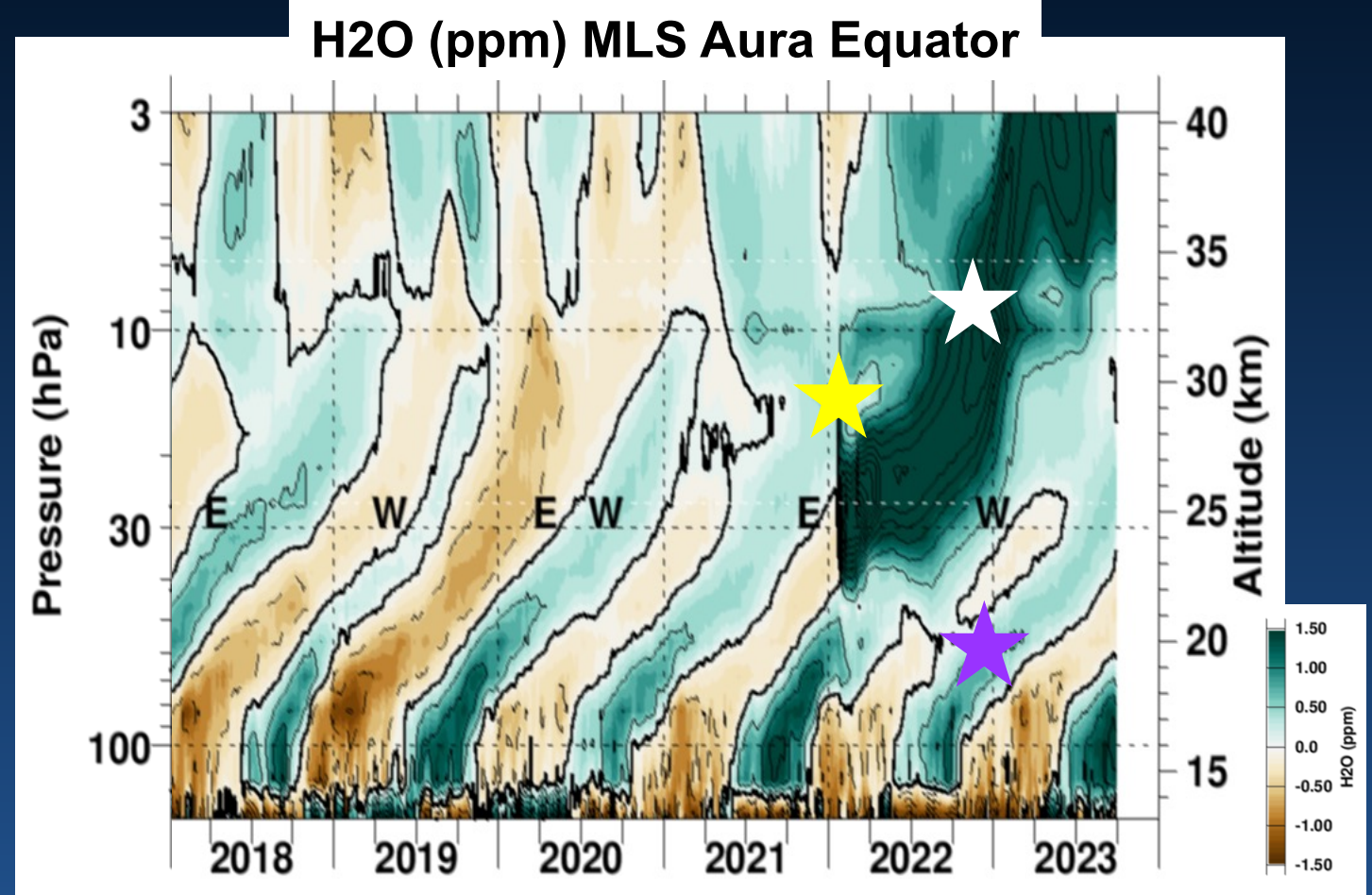
Lightning flash rate density anomalies for the ENSO warm phase (El Nino)

Lightning flash rate density anomalies for the ENSO cool phase (La Nina)

Mean study period lightning flash rate climatology

SPARC: “Hunga-Tonga impacts on the atmosphere” a 2022-25 cross-activity focus project

- ★ At the Equator, the bulk of the H₂O appeared almost immediately after the eruption between 22 and 28 km.
- ★ The H₂O plume is following the normal “tape-recorder” ascent in the tropics with little mixing of high H₂O back into the tropics
- ★ The rate of ascent of the “tape recorder” is modulated by the QBO



Localized Uplift, Widespread Subsidence, and Implications for Sea Level Rise in New York City

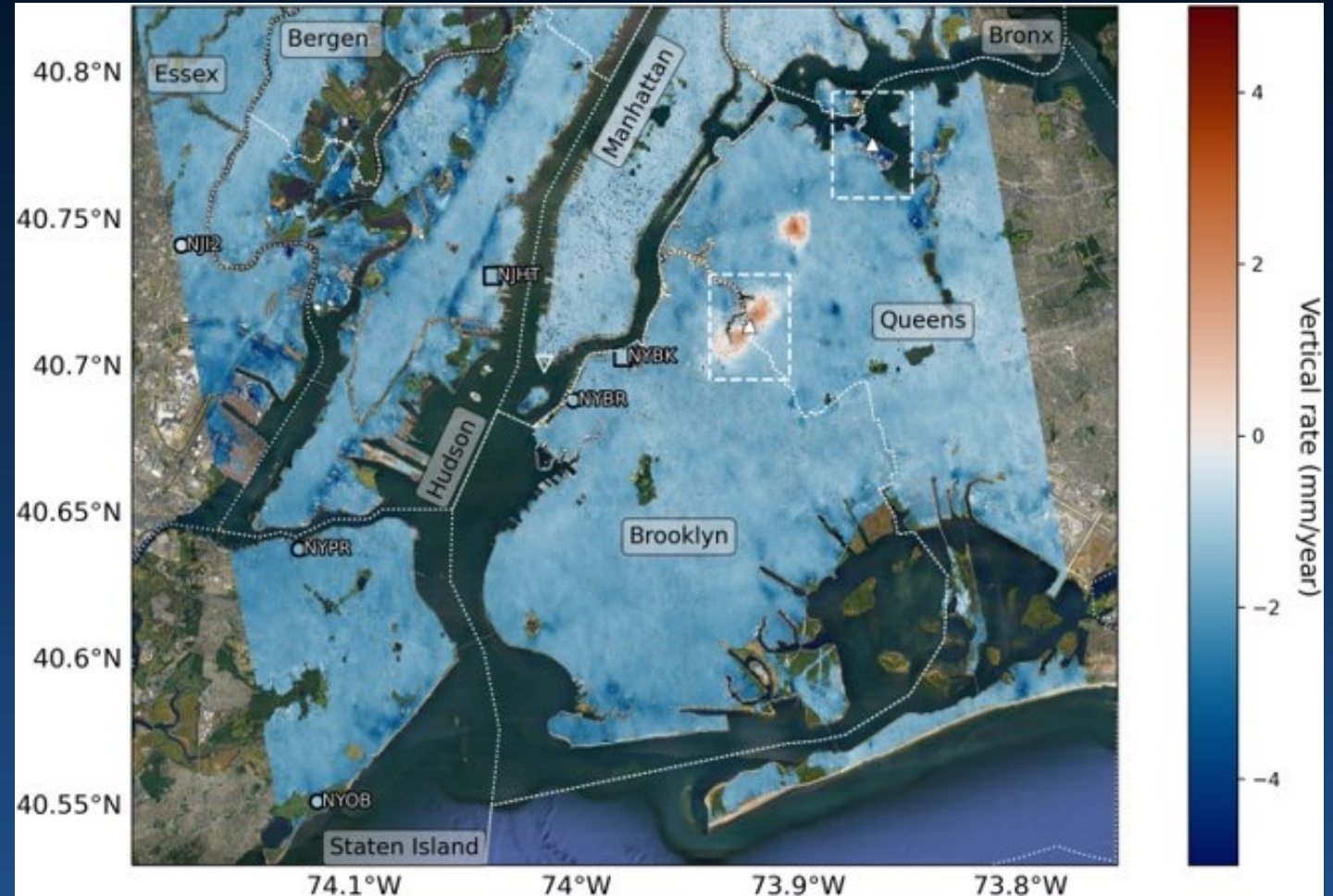
Buzzanga et al., 2023, Vol 9, Issue 39,

[DOI: 10.1126/sciadv.adi8259](https://doi.org/10.1126/sciadv.adi8259)

Broad subsidence of 1.6 mm/year

Previously undocumented hot spots of both subsidence and uplift

Vertical Land Motion rate map: Rates are estimated from Sentinel-1–derived interferograms spanning May 2016 to March 2023. Colored square markers indicate GNSS stations used in referencing InSAR velocities to ITRF14, while circles mark stations used in validation.





ASIA-AQ is an opportunity for international collaboration, working with local partners to apply multi-perspective observations in a consistent strategy across interested Asian countries to improve both specific understanding of local air quality issues and general understanding of common challenges in the interpretation of satellite observations and modeling of air quality.



An aerial photograph of a river delta, likely the Colorado River, showing a complex network of channels and distributaries. The image is overlaid with semi-transparent blue and green shapes, possibly representing water flow or land use. The text is centered in a dark blue horizontal band.

Highlights: Solutions & Societal Value

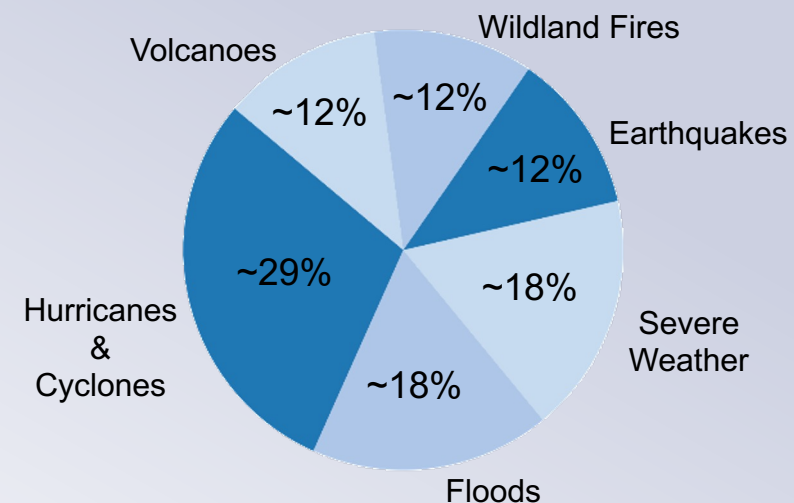
17 Disaster Response Activations In 2023

DISASTER ACTIVATIONS BY REGION

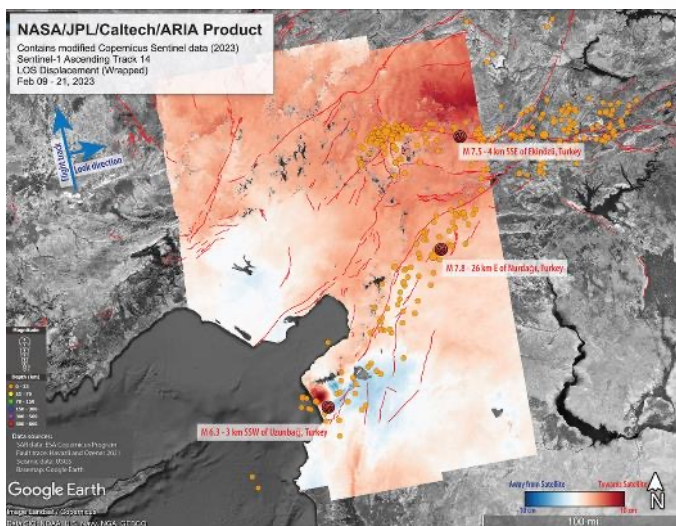
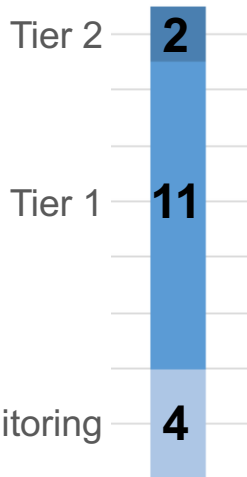


Regions: North America, Europe, Africa, Oceania, South America, Asia

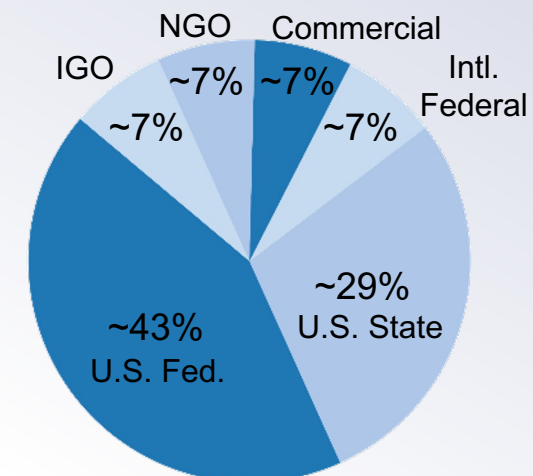
NATURAL HAZARD TYPES



ACTIVATION LEVELS

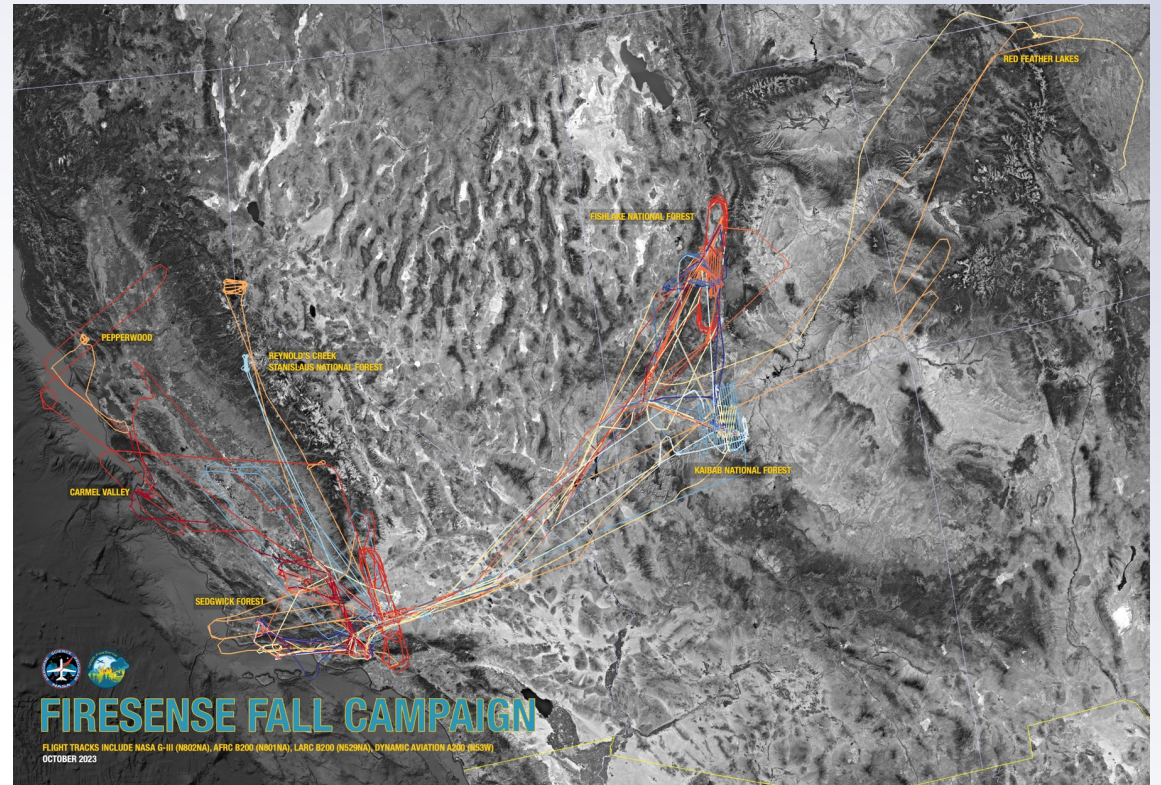


STAKEHOLDER INVOLVEMENT



This surface displacement map from the Feb. 20 earthquake in Türkiye illustrates one type of product NASA Disasters Program provided in 2023. Credits: NASA's Jet Propulsion Laboratory. Copyright contains modified Copernicus Sentinel data (2023) processed by the ESA.

- ~8 weeks at 9 locations across 4 states
- Over 45 participants from 21 institutions
- Community field day with 3 aircraft and 4 sensors
- **Pre-fire**
 - Fuel structure and composition and soil and fuel moisture sampling from air and field
- **Active fire**
 - Spatially coincident thermal IR and imaging spectroscopy from air
- **Post-fire**
 - SAR and imaging spectroscopy for fuel consumption from air and field
- Data use
 - Improve fire and smoke models
 - Understand capabilities of sensors and instruments on satellite missions to support proactive wildland fire management and response (e.g., situational awareness).



BETA
U.S. GHG CENTER

DATA CATALOG DATA ANALYSIS DATA INSIGHTS HUB

ABOUT CONTACT US

U.S. Greenhouse Gas Center

Uniting Data and Technology to Empower Tomorrow's Climate Solutions

NASA EPA NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY U.S. DEPARTMENT OF COMMERCE NOAA

earth.gov/ghgcenter

- U.S. Greenhouse Gas Center (US GHG Center) hosts a Stakeholder Engagement Forum in Washington, D.C. – Nov. 2023
- US GHG Center officially launches at COP28 in Dubai – Dec. 2023
- First Center newsletter released – early March 2024
- User Focus Group meetings begin – mid-March 2024
- Updates published to the Center website – planned April 2024

To sign up for the US GHG Center newsletter or join a User Focus Group, **click 'subscribe'** at the bottom of the Center's home page (earth.gov/ghgcenter).

An aerial photograph of a river network, likely a delta or a large confluence, with several blue overlays highlighting specific channels and their tributaries. The background is a natural color satellite image showing green vegetation and brownish terrain. The blue overlays are semi-transparent and follow the main channels and their immediate tributaries.

Highlights: Public Understanding & Exchange

ARSET participation in 2023

Offers online and in-person trainings for beginners and advanced practitioners.

Trainings cover a range of NASA datasets, web portals, and analysis tools and their applications to health and air quality, agriculture, climate and resilience, disasters, ecological conservation, and water resources management.

In 2023, ARSET reached its 100,000th participant. Since 2009 it has reached participants from 180 countries and more than 17,000 organizations worldwide.

Now offers online, self-paced trainings.

In 2023:

19,756

Total Participants

5,110

On-Demand Training Participants

14,646

Live Training Participants

158

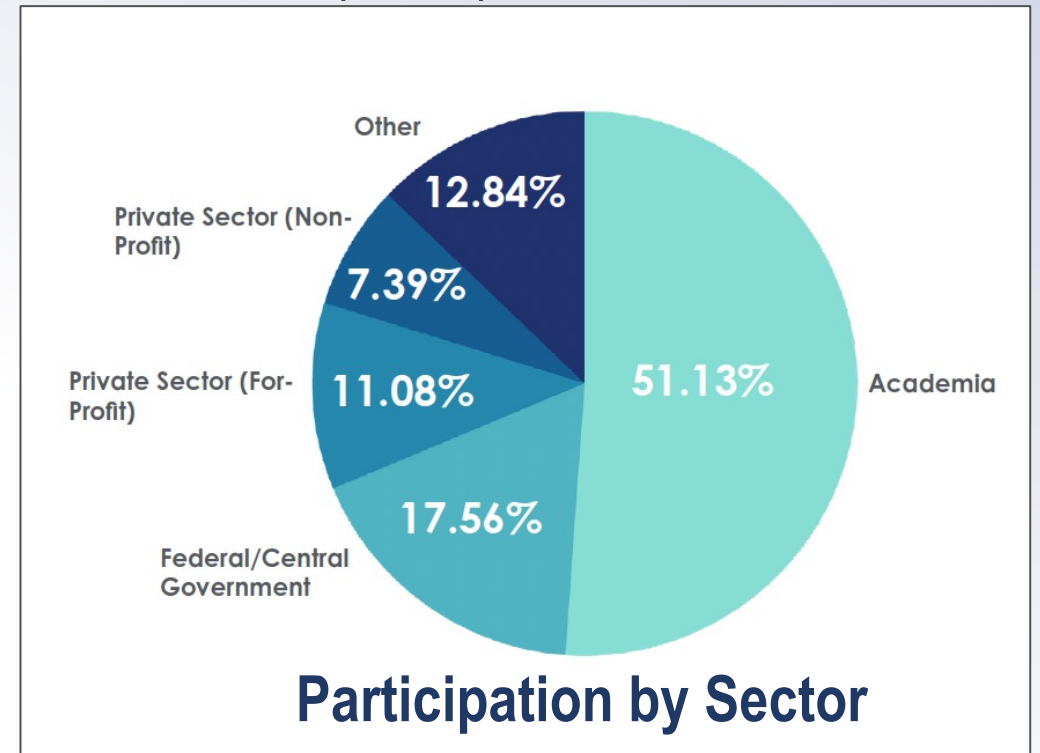
Countries Reached

53

US States & Territories Reached

4,740

Unique Organizations Reached



User-centered approaches in practice

Ag Data Transparent (ADT) has partnered with NASA Acres to develop a set of guiding principles to be used for managing farm data in their research. These principles aim to promote beneficial and safe data collection, sharing, and use that prioritize farmers' well-being while unlocking the value of satellite data for farmers. In 2024, NASA Acres, ADT, and Farm Journal's Trust In Food will launch a survey and organize outreach sessions to gather perspectives on pain points, needs, priorities, and opportunities for collaboration and trust-building around collaborations that involve farm data.

Space for Agriculture, A Listening Tour: NASA's Agriculture team traveled to Iowa and met with the Iowa Corn Growers Association along with other industry partners, land-grant universities, and local producers. Discussions were focused on the data and products farmers and industry partners need to enhance their decision making when it comes to planting timing, reducing nutrients and other inputs, measuring benefits of different crop management practices, climate resilience, and sustainability.

Commodity Classic: NASA's Agriculture team attended Commodity Classic, America's largest farmer-led convention. Keynote panel discussions, presentations and demos served to educate attendees about the work that NASA is doing in agriculture and provided participants with the opportunity to ask questions and provide commentary about our work and their needs.

The logo for NASA Acres, featuring the word "Acres" in a white, sans-serif font with a stylized green leaf and a white satellite-like arc above the letter 'A'.

FY 24-25 Milestones

