



National Aeronautics and  
Space Administration

# NASA earth

**Earth Science to Action in Africa**

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Earth Science Division



# NASA Earth Fleet

## International Collaborations

- (Pre) Formulation 
- Implementation 
- Primary Ops 
- Extended Ops 



# NASA/ESA Joint Program Planning Group (JPPG) 2024



**The vision:** ESA and NASA are aware of current and future applications offerings and technical capabilities, learn from one another, and align resources where practical and beneficial, developing more complementary, effective applications for end users.

# Earth Science to Action: an overview

The strategy taps into ESD's end-to-end capability as an open enterprise to incorporate innovation, scientific discovery, and emerging user needs to accelerate the use of Earth science and inform the next iteration of programs, missions, and initiatives.

## objectives:

- Holistically observe, monitor, and understand the Earth system
- Deliver trusted information to drive Earth resilience activities

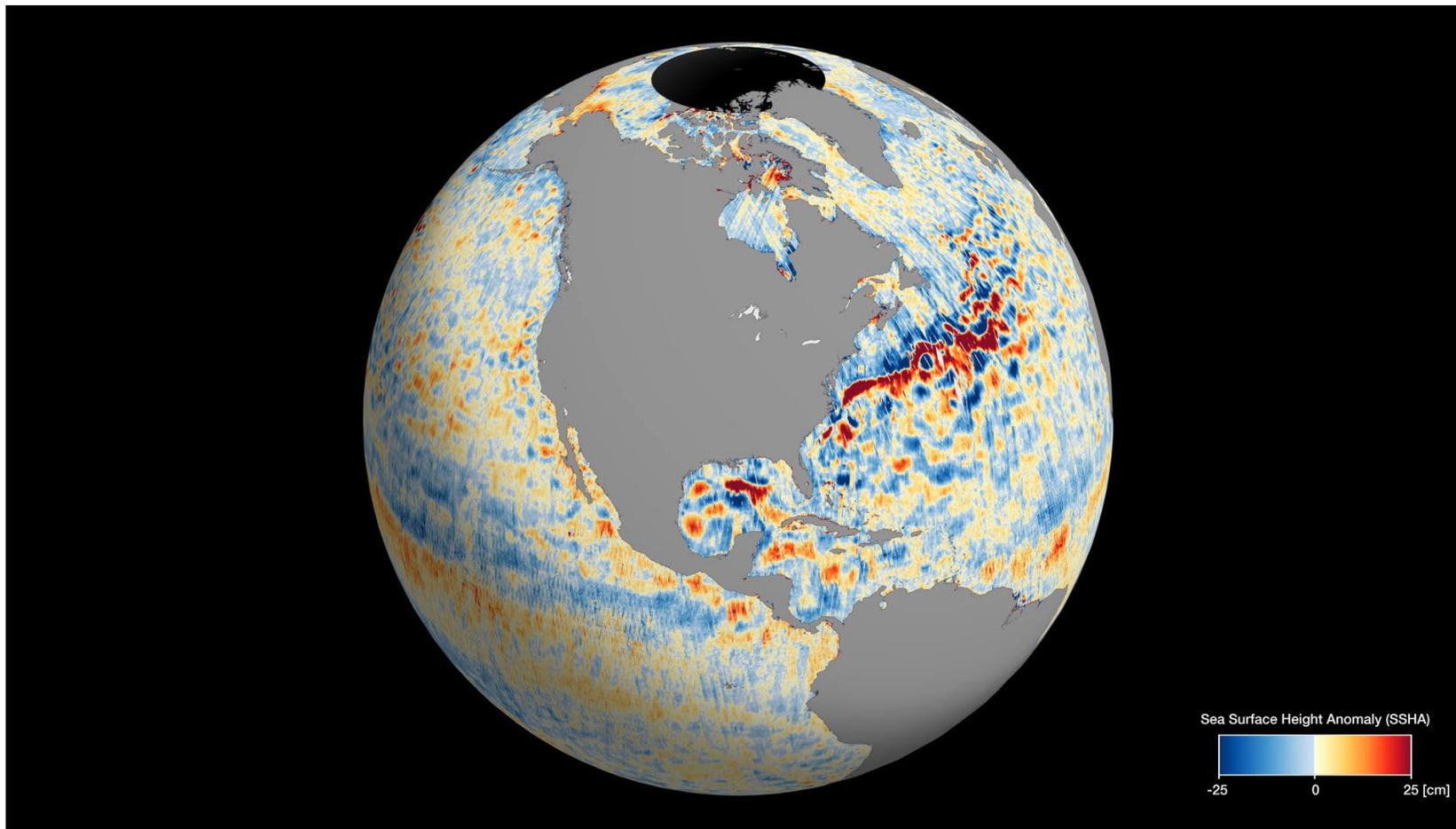
The background of the slide is a satellite-style image of Earth, showing a mix of green, brown, and blue tones. The NASA Earth logo is prominently displayed in the center-right area. The word "NASA" is in a bold, white, sans-serif font, and "earth" is in a larger, white, lowercase sans-serif font below it. The logo is partially overlaid by a dark blue curved shape that frames the text.

NASA  
earth

# Earth Science to Action Strategy



# Surface Water & Ocean Topography



- ✓ Advanced wide swath technology
- ✓ Ocean and surface water topography measurements
- ✓ High Resolution Products
- ✓ Supporting Societal need

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

# NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission

- Extend key systematic **ocean color, aerosol, & cloud climate data records**.
- Reveal **diversity of organisms fueling marine food webs** & how ecosystems respond to change.
- **Looking at the ocean, clouds, and aerosols together** will improve knowledge of the roles each plays in our planet.

## Key characteristics:

- Launched February 2024
- 3-yr design life; 10-yr propellant
- 3 onboard instruments
  - Hyperspectral Ocean Color Instrument (OCI)
  - 2 multi-angle polarimeters (HARP-2 and SPEXone)



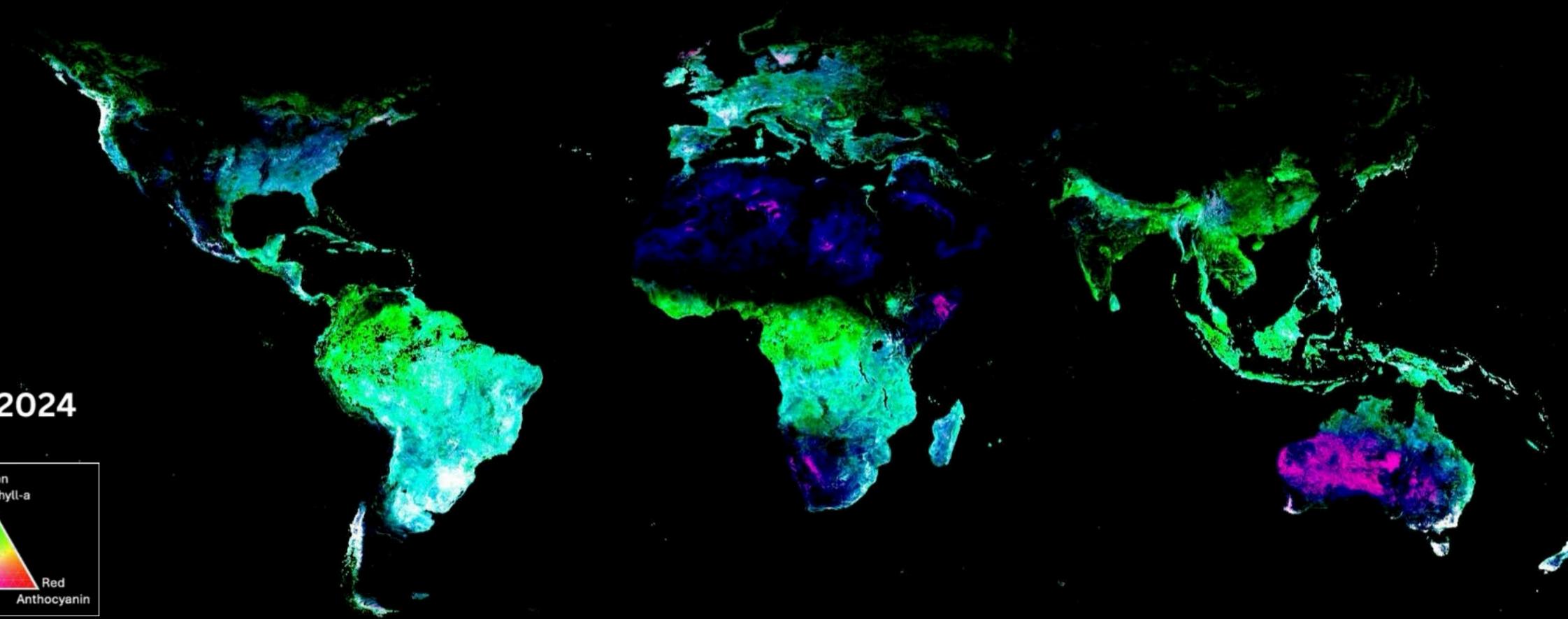
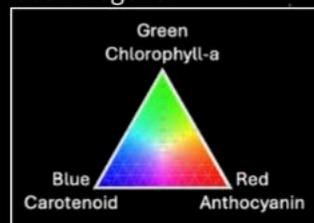


# First Look: PACE Terrestrial Data Products from March-August 2024

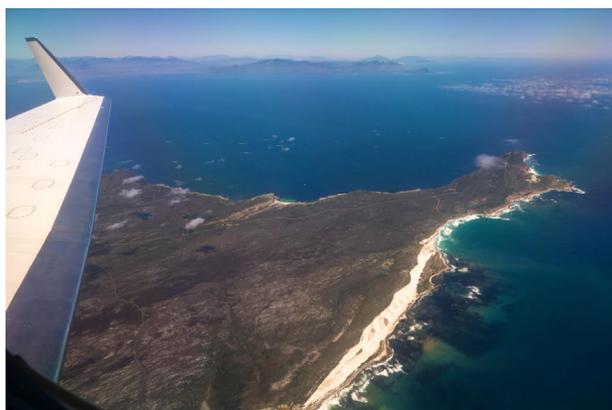
Boreal spring, for the first time, visualized globally with 3 hyperspectral-based pigment indices

March 2024

Color Legend



PACE's advanced pigment indices contain information on vegetation type, productivity, health status, and leaf area. Only PACE can provide this information globally, every 1-2 days.



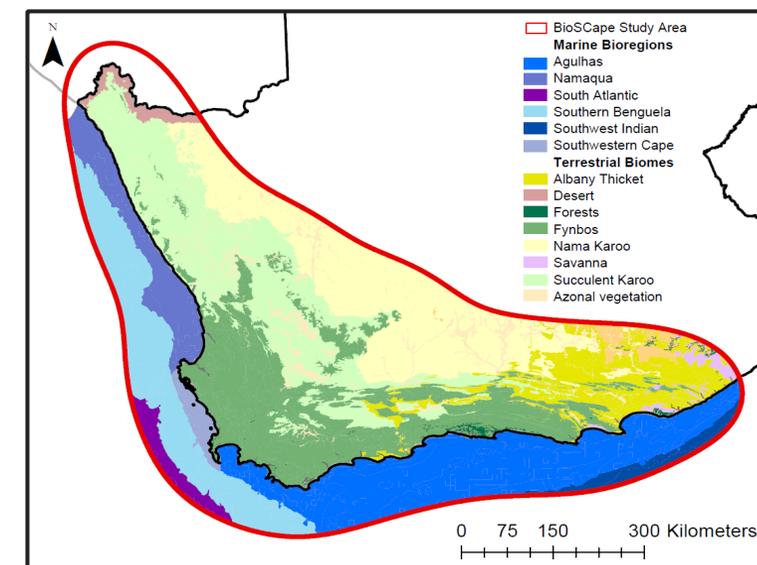
# Biodiversity Survey of the Cape



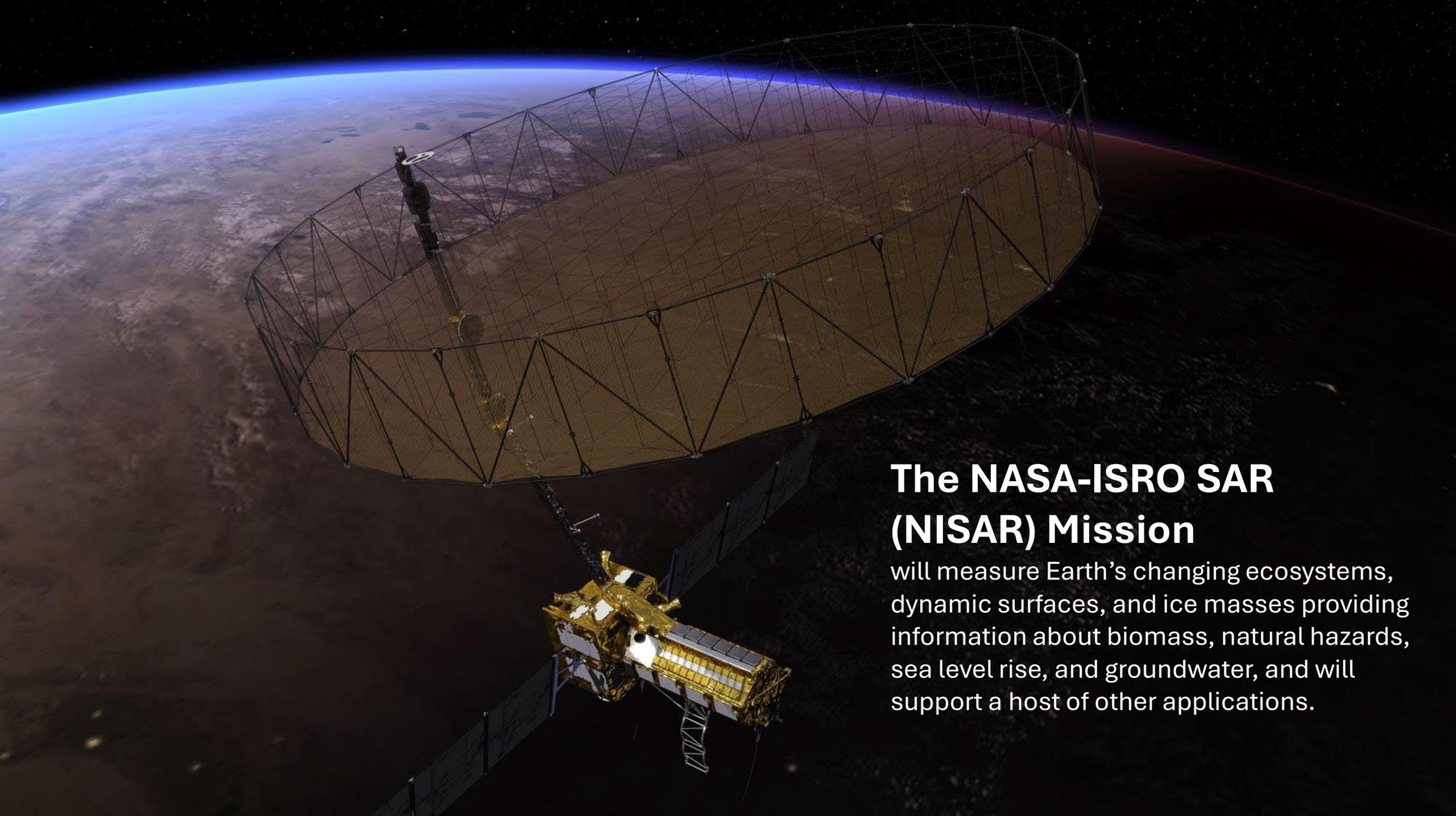
**Objective:** Measure and understand the biodiversity of the lands and seas of South Africa's megadiverse, highly endemic Greater Cape Floristic Region

## Partners:

- South African Environmental Observation Network (SAEON)
- National Research Foundation (NRF)
- Council for Scientific and Industrial Research
- South African National Biodiversity Institute
- University of Cape Town
- Stellenbosch University
- SUNY Buffalo
- University of Connecticut



*BioScape 2023 Study Area:  
The Greater Cape Floristic Region (GCFR)*



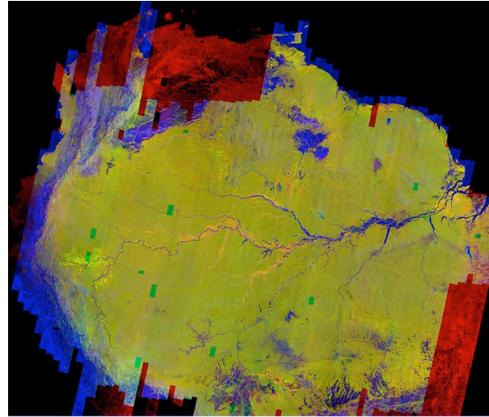
## **The NASA-ISRO SAR (NISAR) Mission**

will measure Earth's changing ecosystems, dynamic surfaces, and ice masses providing information about biomass, natural hazards, sea level rise, and groundwater, and will support a host of other applications.

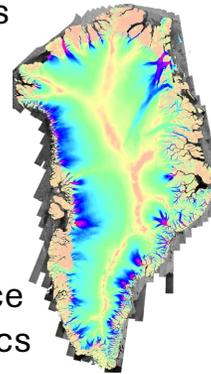
# NISAR

Global systematic, all-weather, day-night, time-series measurements of surface deformation and change

## Climate, carbon, and catastrophic change

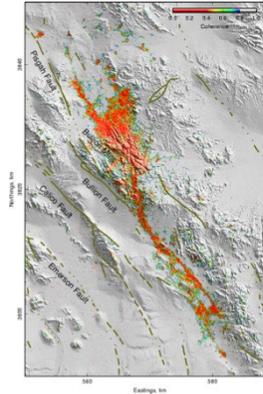


Global Biomass Dynamics

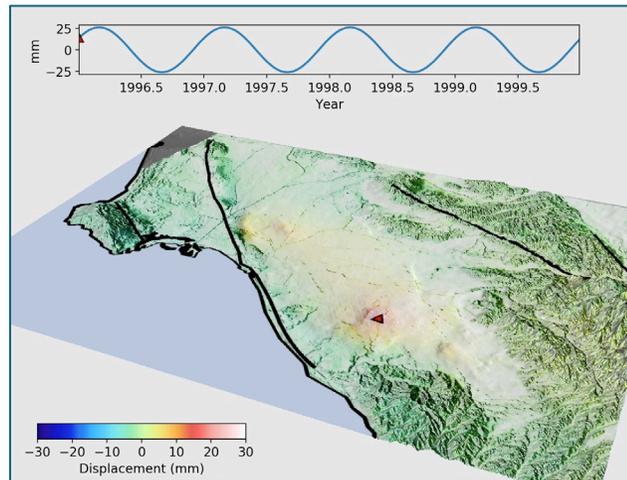


Global Ice Dynamics

Earthquake damage



## Resource Management



Aquifer Health

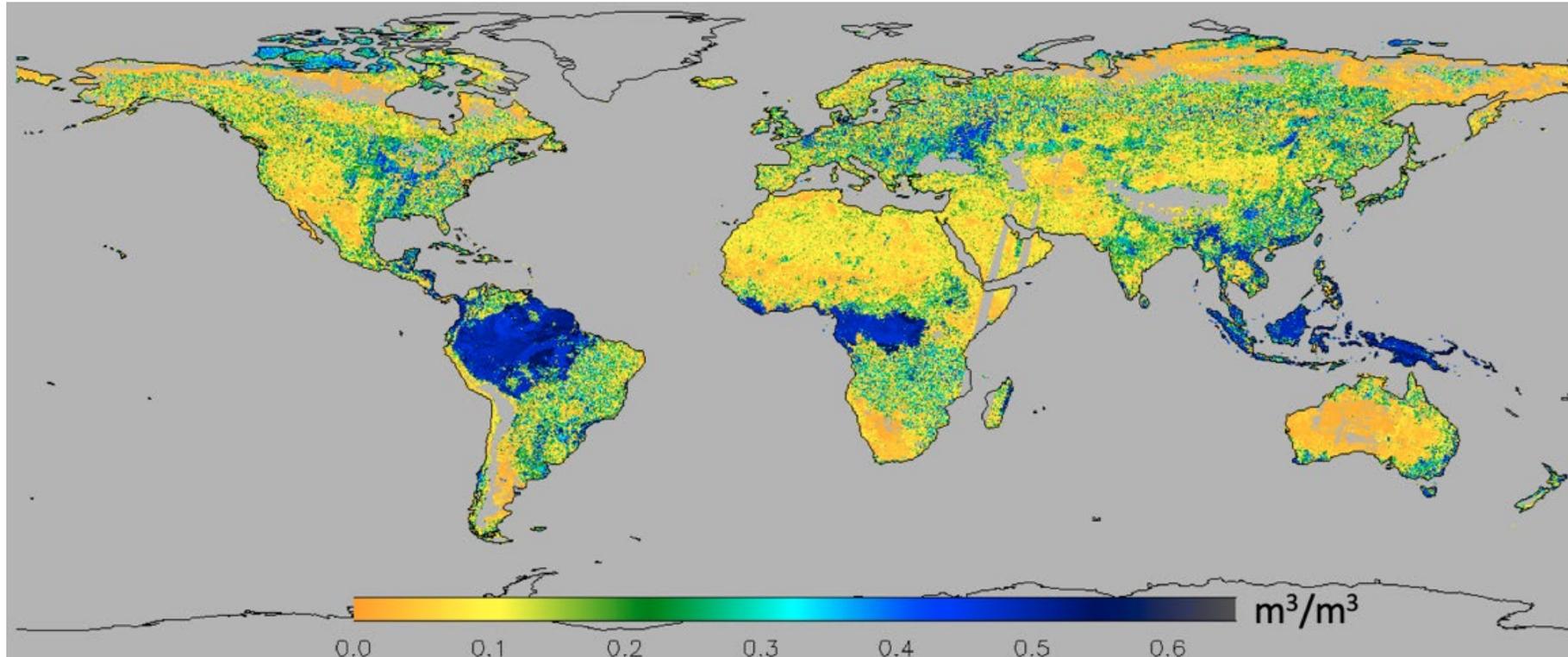
Agricultural Activity



# NASA-ISRO Synthetic Aperture Radar (NISAR) Mission

## Global coverage with short revisit

- NISAR will map surface soil moisture globally every 6 to 12 days at the spatial scale of individual farm fields.
- Applications to agriculture, drought, and weather models.
- Also useful for crop monitoring and disaster response and assessment.



Global map of surface soil moisture imaged by the radar onboard NASA's Soil Moisture Active Passive satellite (SMAP) at 3-km spacing over an 8-day period in May, 2015. [Kim et al., TGRS, 2017]

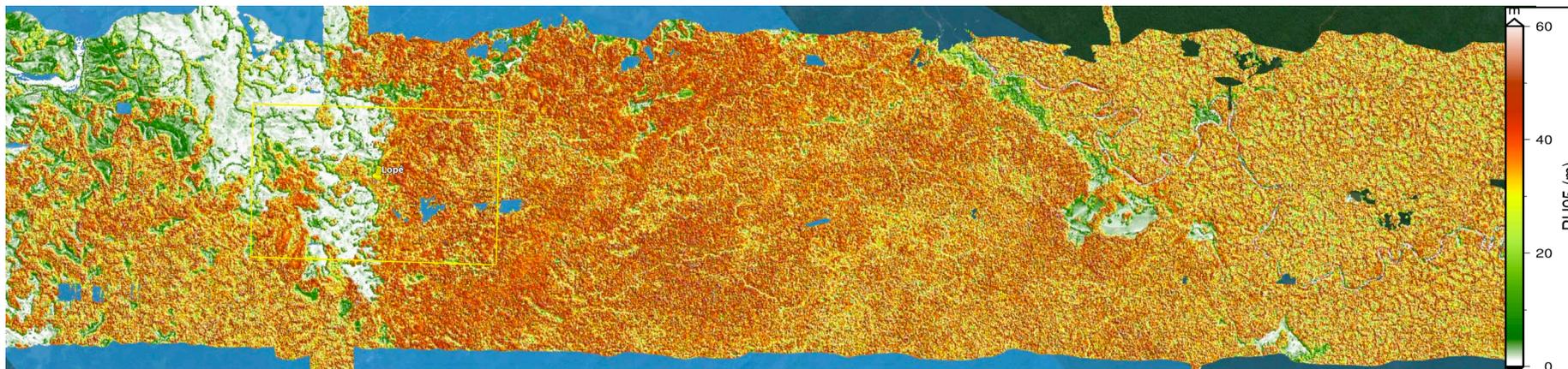
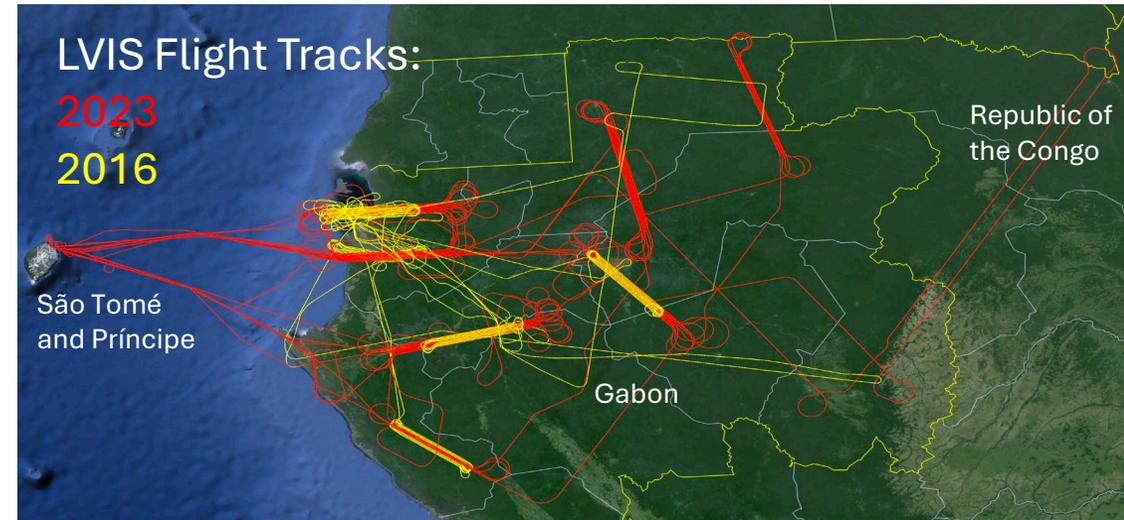
# AfriSAR

A joint ESA/DLR and NASA Airborne Campaign over Gabon

**Goal:** Generate cal/val dataset in tropical environments for GEDI, NISAR and BIOMASS missions, determining:

- above ground vertical structure
- wetland flood extent
- below-canopy topography
- carbon stocks and changes

**Location:** Gabon, Sao Tome and Principe; Cameroon, Republic of Congo, Democratic Republic of Congo, Ghana



LVIS measured sub-canopy topography (not shown) and canopy height for a section of the Lope National Park, Gabon. This area was flown as part of AfriSAR in 2016, and again in 2023 by LVIS and the DLR sensor (the 5 x 8 km area targeted by the DLR is shown within the yellow box) and has numerous ground-based measurements of canopy structure available for comparison.

## 2024 Priorities:

- Expand data collection to new sites and countries
- Collect P- and L-band data over NISAR cal/val sites for biomass, wetland extent, and water levels

# Multi-Angle Imager for Aerosols

An international partnership with **Agenzia Spaziale Italiana (ASI)** that will study the impacts of different types of particulate air pollution on human health. Launch in 2026.



- Primary Target Areas (PTAs): Surface monitor data collections and epidemiological studies
- Secondary Target Areas (STAs): Air quality and climate studies
- Calibration/Validation Target Areas (CVTAs): Instrument and algorithm performance maintenance

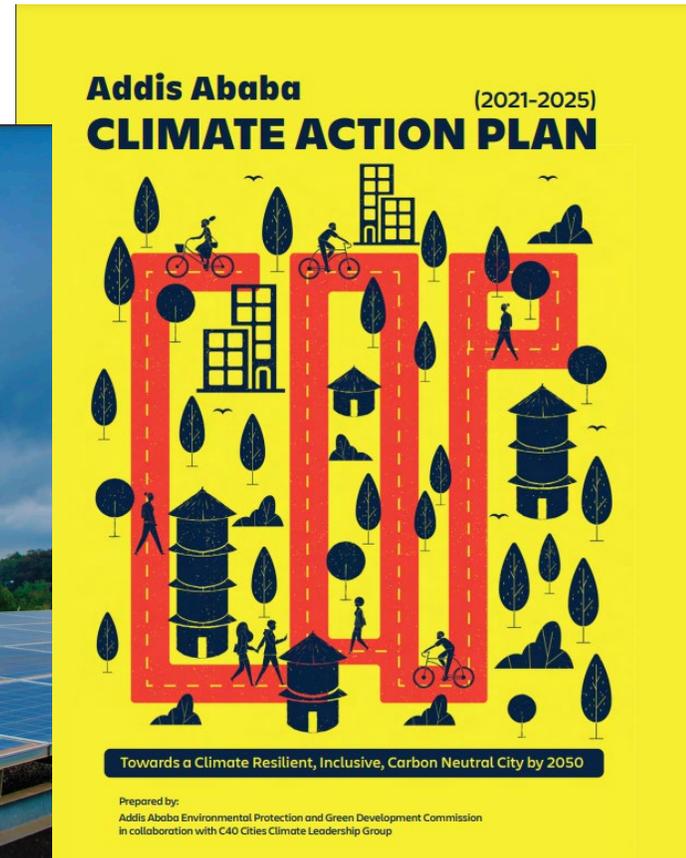
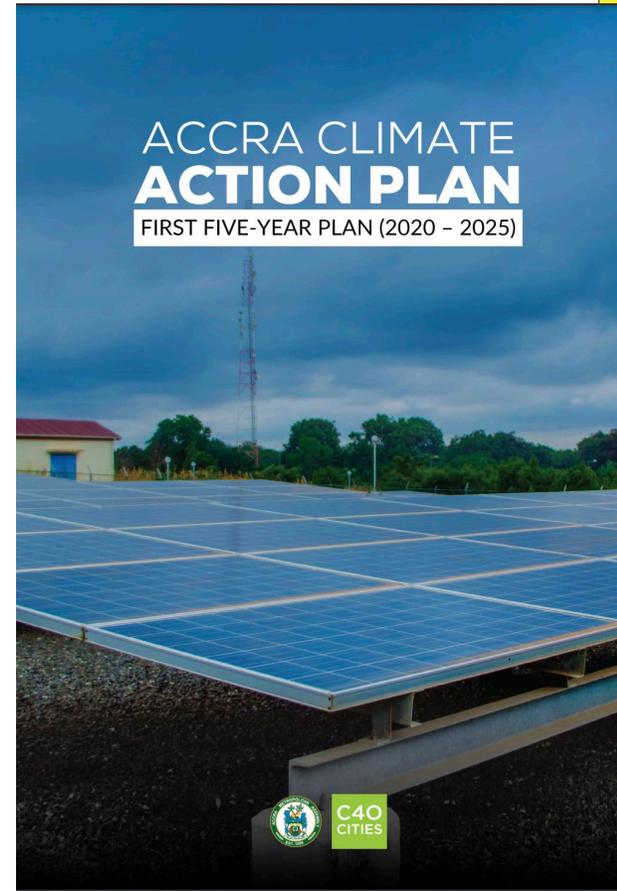


- Pointable spectro-polarimetric camera for aerosol retrievals
- Surface monitors to complement the satellite data
- Chemical transport model (WRF-Chem)
- Epidemiology Studies



# NASA Data Support African Climate Action Plans

- 6 global cities, including 3 in Africa, have incorporated NASA PM2.5 data in their Climate Actions Plans
- These data allow cities to quantify the co-benefits of GHG mitigation strategies on air quality and health
- Accra, Addis Ababa, and Johannesburg have all published Climate Actions Plans with these data



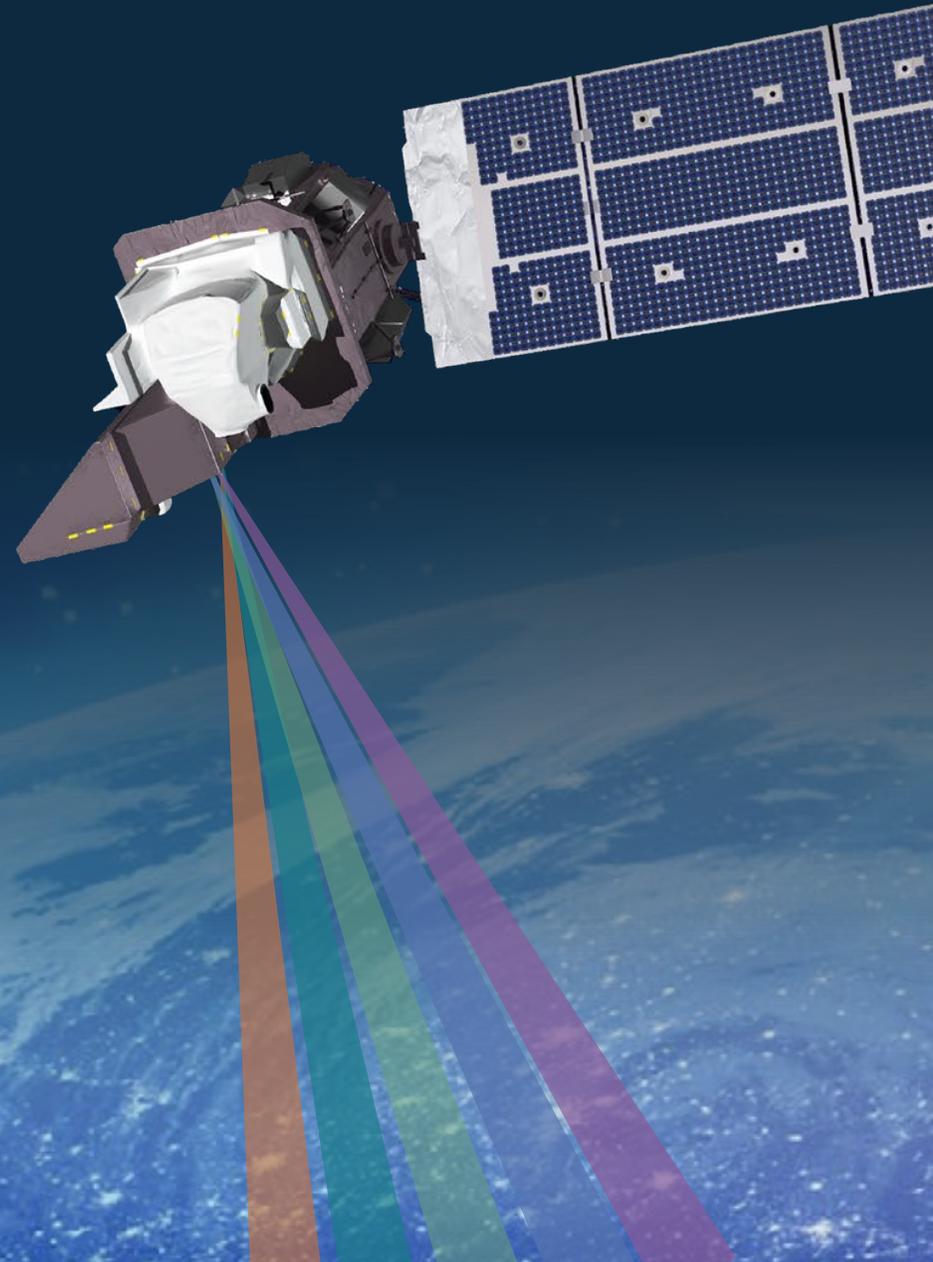
*“By fully implementing the ambitious scenario, Accra can reduce PM2.5 by 21  $\mu\text{g}/\text{m}^3$  in 2050.”*



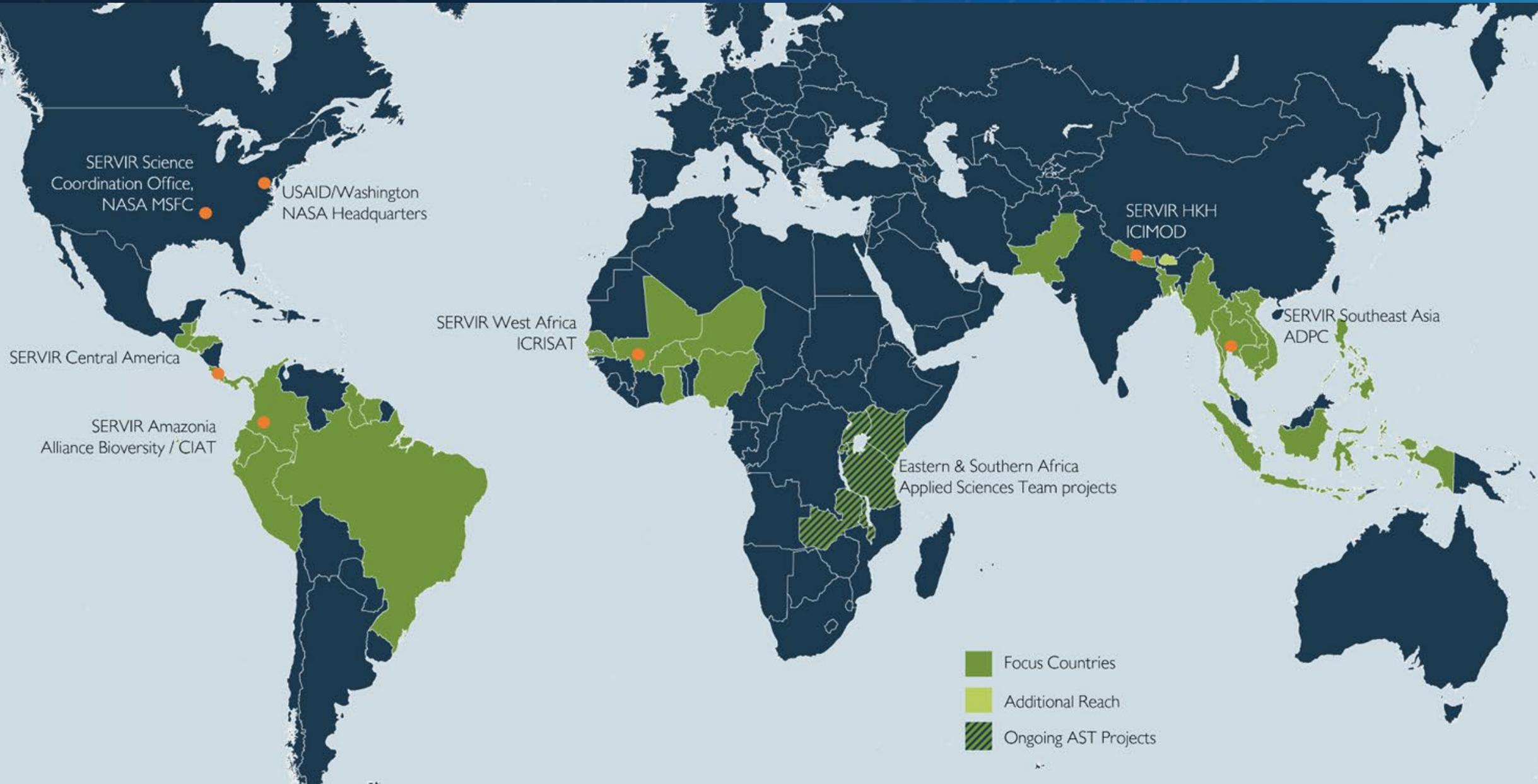
# CONNECTING SPACE TO VILLAGE



**SERVIR** is a joint initiative of NASA, USAID, and leading geospatial organizations in Asia, Africa, and Latin America that partners with countries and organizations to address challenges in climate change, food security, water and related disasters, forest and carbon management, and air quality.



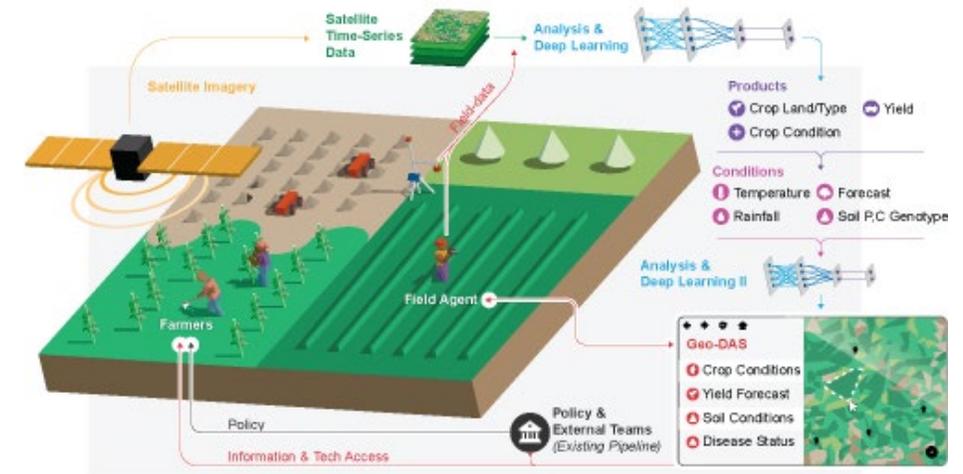
# SERVIR Focuses on Countries in Asia, Africa, & the Americas



# Earth Observation for Regional and National Agricultural Monitoring



- Centre de Suivi Ecologique (CSE) in Senegal and SERVIR West Africa are working to improve spatial information of:
  - Crop type
  - Crop area
  - Crop condition
  - Yield estimation
- Piloted in Senegal, with plans to scale to West Africa
- Includes Capacity Building efforts with CSE
- Builds on work in Eastern and Southern Africa



Researchers collect field data in Senegal. Photo credit: CSE

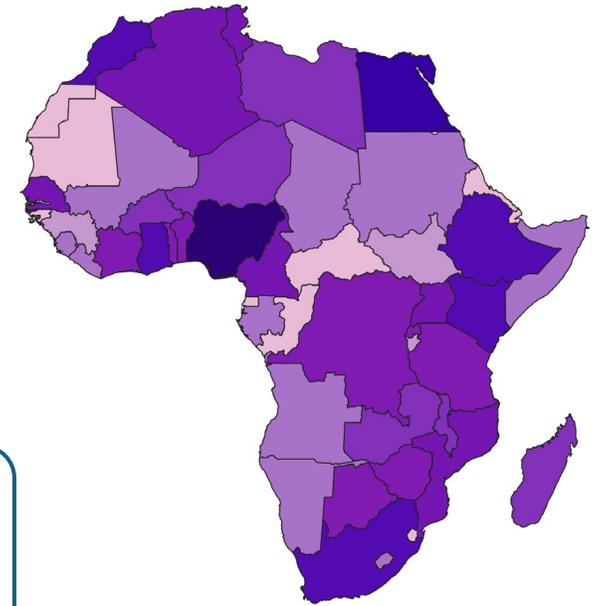
# Opportunities

## Remote Sensing Training (ARSET)

**Cost-free training on the use of Earth Observations for decision making**

- Online and in-person
- Live, instructor-led, or self-guided
- Provided at no cost, with materials and recordings
- Often multi-lingual
- All levels, from introductory to advanced

**ARSET has trained participants in all countries in Africa.**



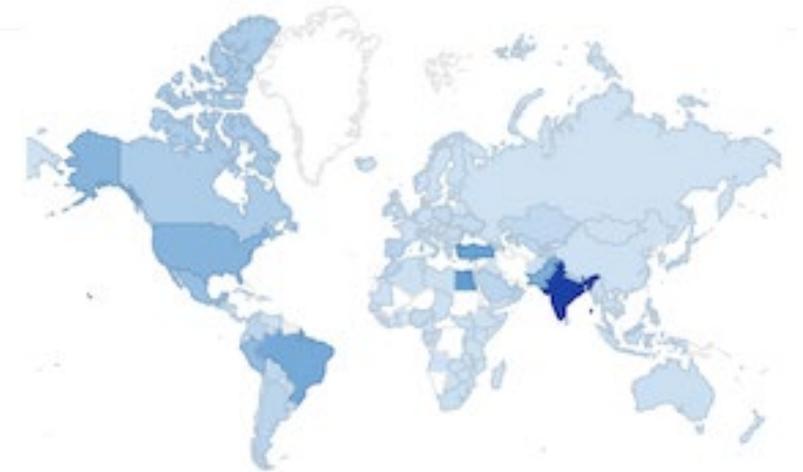
## Space Apps Challenge

The NASA International Space Apps Challenge is the world's largest global hackathon where teams utilize NASA's free and open data to address real-world problems on Earth and in space.

- 2-day event
- Local and virtual events hosted worldwide

**Mission:**

- Inspire collaboration, creativity, critical thinking
- Foster interest in Earth and space science and technology
- Encourage growth, nurture interest in STEAM within the next generation

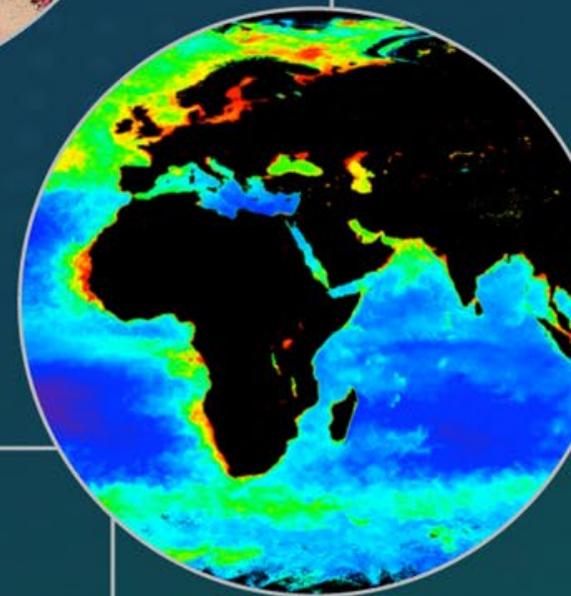
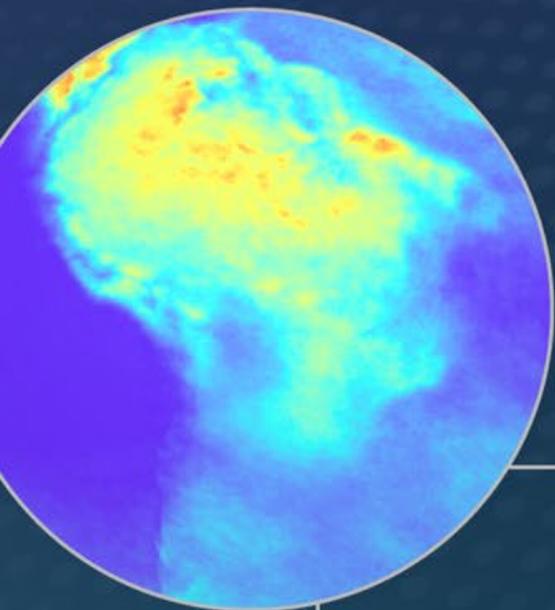
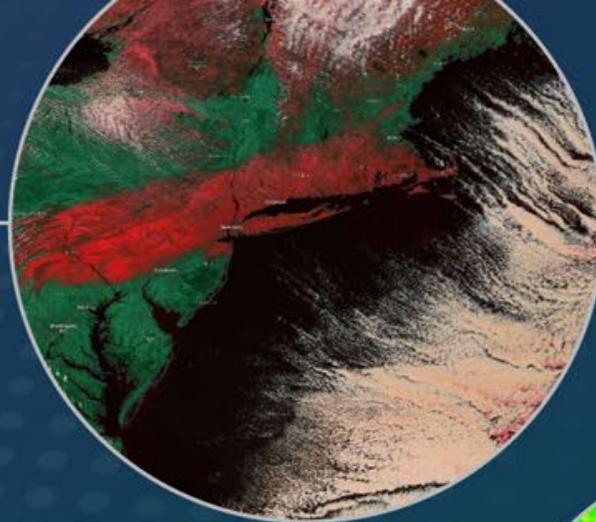


**In 2023, Egypt had the second highest number of participants globally!**

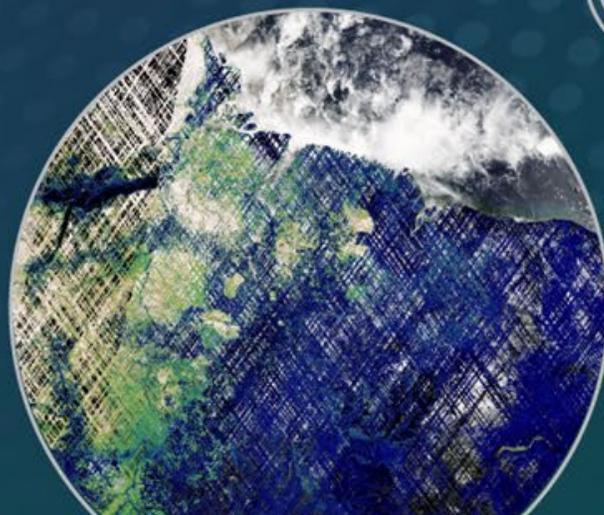


# EARTHDATA RESOURCES FOR SUPPORTING OPEN SCIENCE

NASA provides unrestricted access to Earth science data, data tools, source code, and online training. From discovery to visualization, our openly available resources support your research at every stage of the data lifecycle.



Scan to access NASA's  
open science resources





# Open Data and Open Science



## ACCELERATE

Accelerate major scientific discoveries



## BROADEN

Broaden participation by historically excluded communities



## UNDERSTAND AND ADOPT

Increase understanding and adoption of open science principles and techniques

BETA

## SCIENCE DISCOVERY ENGINE

Empowering open science, the Science Discovery Engine allows you to explore the universe, from the tiniest of cells to the vastness of space, through discovery of NASA's science data, documentation, and code. [Read More](#)

⚙️ All ▾  🔍

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The NASA Science Explorer (SciX) is a digital library portal for researchers in Astronomy, Earth Science, Heliophysics, Physics, and Planetary Science. It contains over 20 million records covering refereed publications plus all arXiv, ESS Open Archive, and EarthArXiv preprints.

The **Science Discovery Engine** is a search platform that enables discovery of over 85% of NASA's open science data and documentation across disciplinary areas.

FIGURE C

## Global risks ranked by severity over the short and long term

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period."

### Risk categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

### 2 years



### 10 years



### Source

World Economic Forum Global Risks  
Perception Survey 2023-2024.



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