

# HQ Updates & Perspective

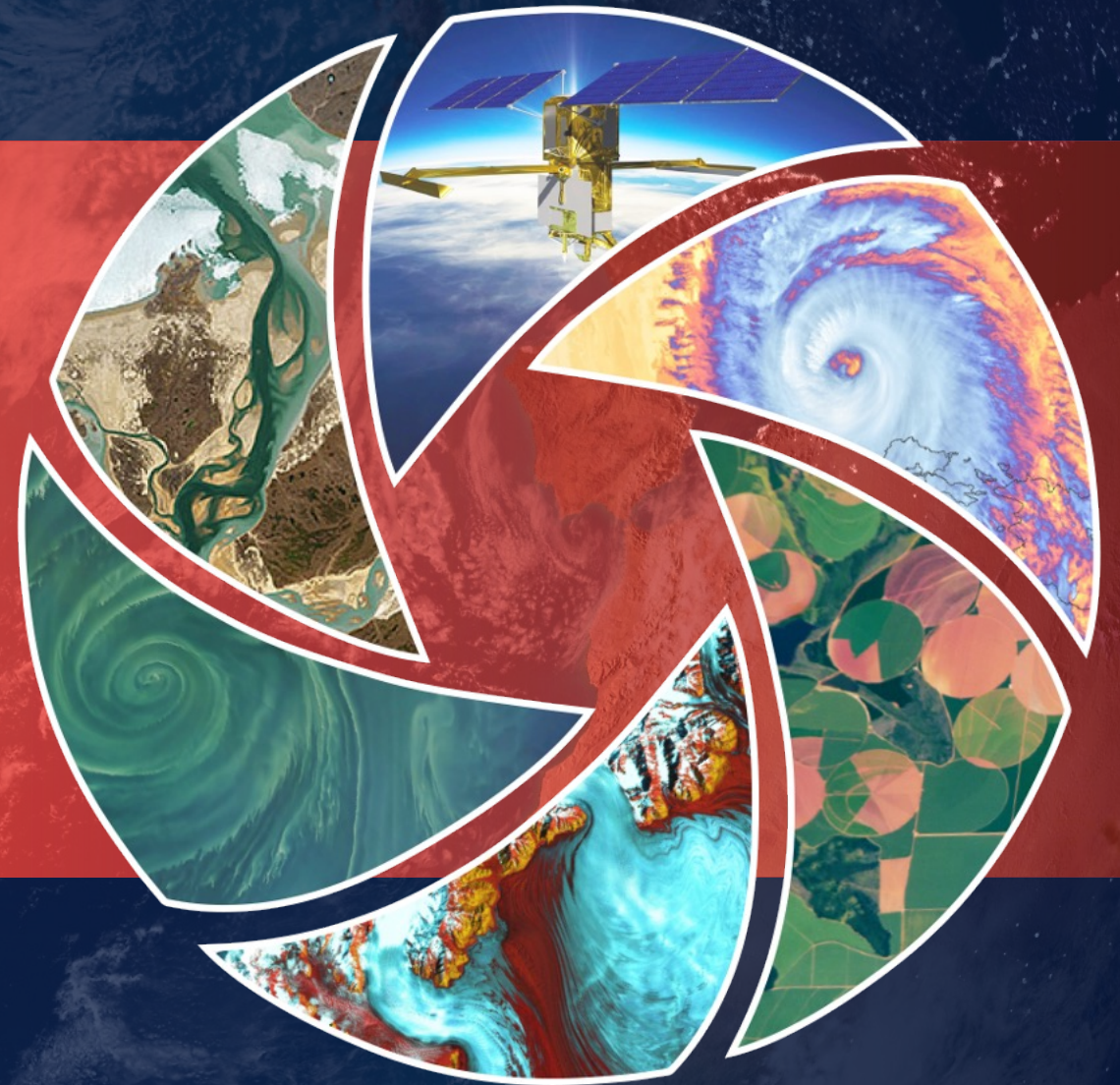
OB.DAAC User Working Group | May 8, 2023

**Joel Scott**

Program Executive, Earth Science Data Systems

Chief Science Data Office

NASA Headquarters



# EARTHDATA

OPEN ACCESS FOR OPEN SCIENCE

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# Discussion Highlights

- Why You're Here
- Why I'm Here
- Where We're Going
  - The Earth System Observatory
  - Open-Source Science
- How We're Getting There

# Why You're Here

- The OB.DAAC UWG represents and advocates for user communities of practice and potential. Specifically, that means you...
  - Assess the quality and responsiveness of DAAC offerings to community needs
  - Recommend new data sets
  - Suggest improvements to UX
  - Recommend new capabilities and suggest priority activities
  - And more! (Y'all are awesome!)



# *Why We're Here*



Cerese Albers, Lead Program Executive  
Earth Science Data Systems  
NASA Headquarters



Joel Scott, Program Executive  
Earth Science Data Systems  
NASA Headquarters



**EARTHDATA**

OPEN ACCESS FOR OPEN SCIENCE

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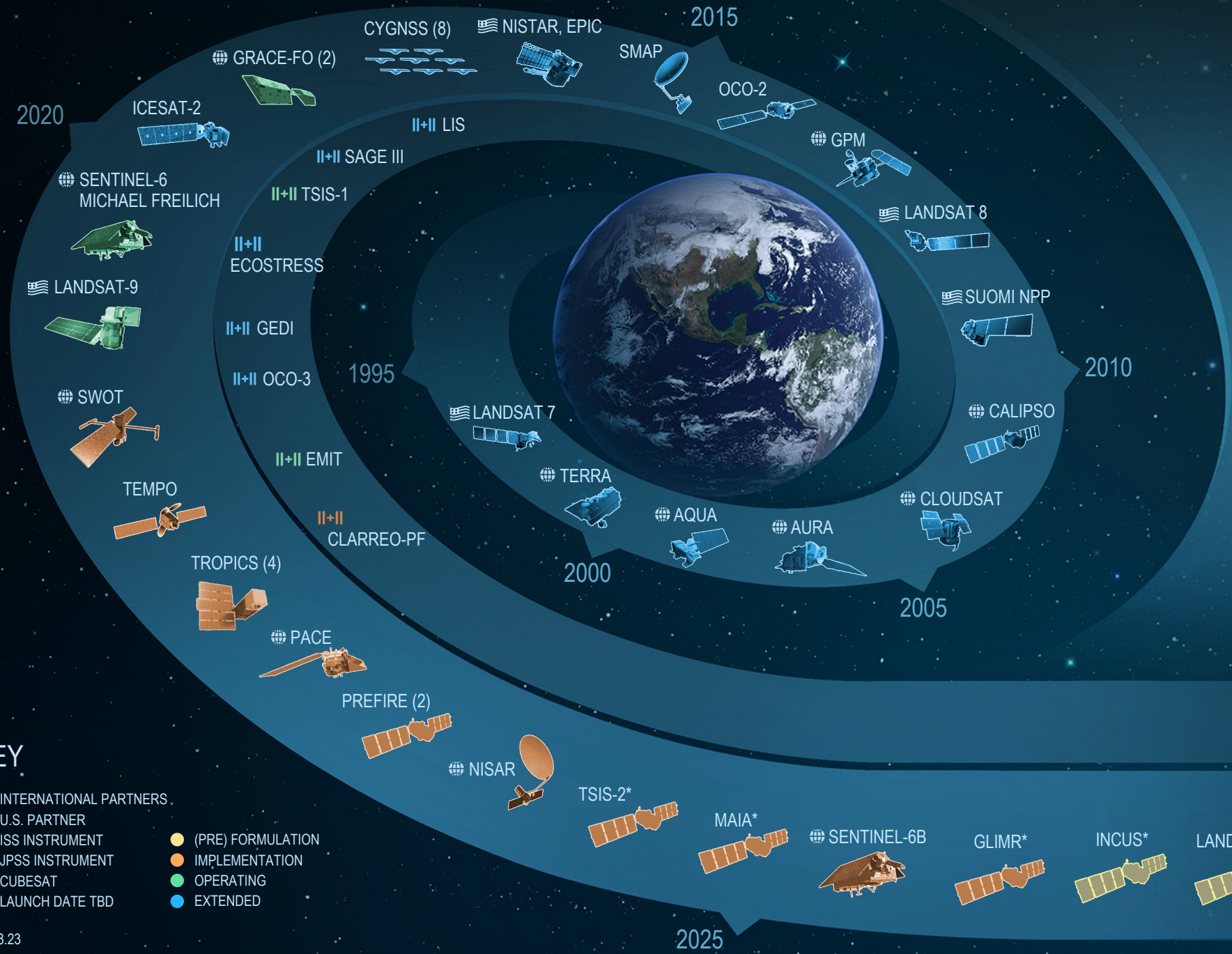
# Where We're Going

As NASA Earth Science Division &  
Earth Science Communities





# EARTH FLEET



## INVEST/CUBESATS

- CIRIS 2023
- NACHOS 2022
- CTIM 2022
- NACHOS-2 2022
- MURI-FD 2022
- SNOOPI\* 2023
- HYTI\* 2023

## JPSS INSTRUMENTS

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

## ISS INSTRUMENTS

## MISSIONS

### KEY

- INTERNATIONAL PARTNERS
- U.S. PARTNER
- ISS INSTRUMENT
- JPSS INSTRUMENT
- CUBESAT
- LAUNCH DATE TBD
- (PRE) FORMULATION
- IMPLEMENTATION
- OPERATING
- EXTENDED

# Future Ocean Color Missions



- PACE
  - Launch date: Jan 2024
  - Data: hyperspectral imagery and multi-angle, hyperspectral polarimetry (~660 TB/yr)
- GLIMR
  - Delivery to NASA in 2024
  - Data: hyperspectral imagery (~255 TB/yr)



# EARTH SYSTEM OBSERVATORY

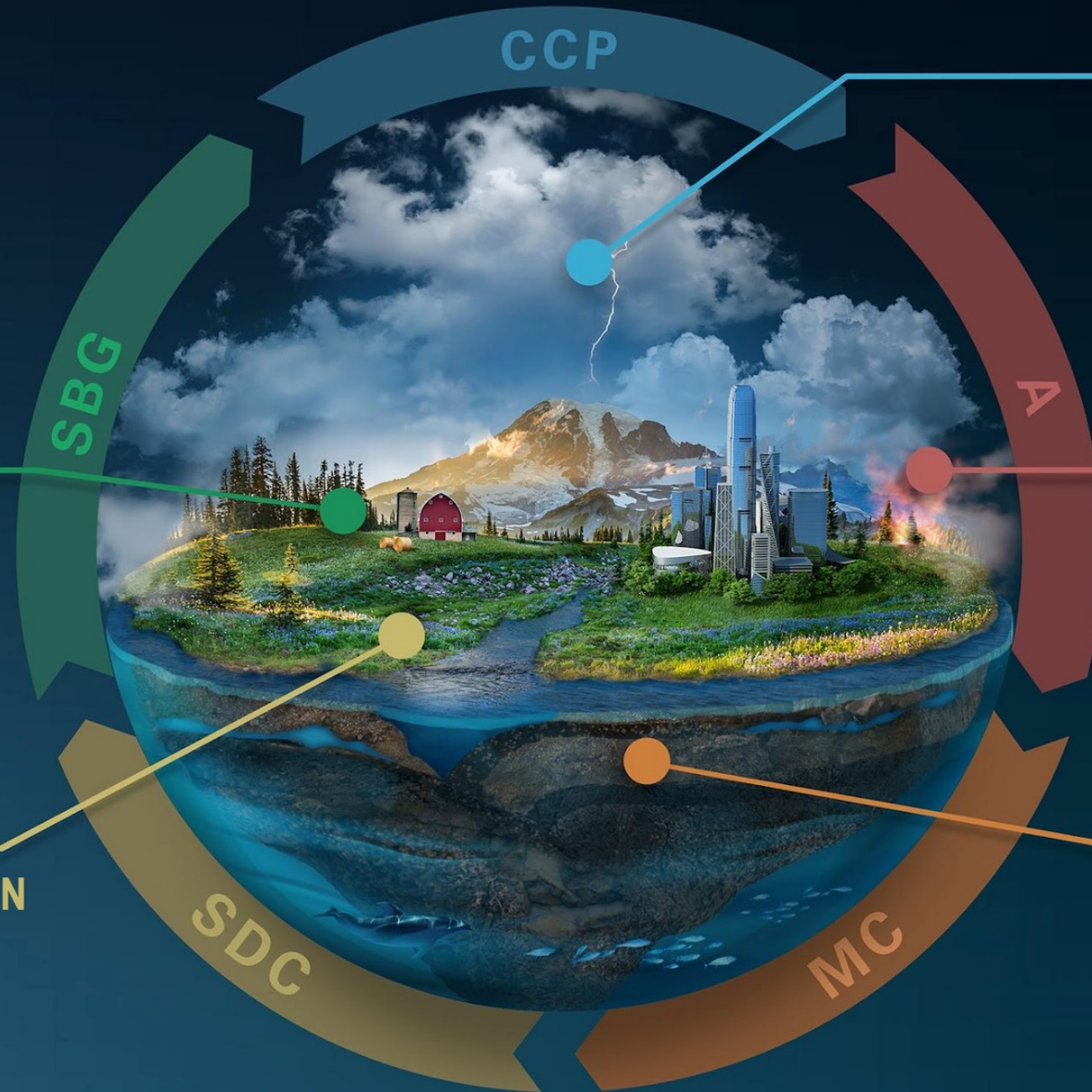
INTERCONNECTED CORE MISSIONS

## SURFACE BIOLOGY AND GEOLOGY

Earth Surface & Ecosystems

## SURFACE DEFORMATION AND CHANGE

Earth Surface Dynamics



CCP

## CLOUDS, CONVECTION AND PRECIPITATION

Water and Energy in the Atmosphere

## AEROSOLS

Particles in the Atmosphere

## MASS CHANGE

Large-scale Mass Redistribution

SBG

A

SDC

MC



# *ESO Missions: Current Status*

- Passed KDP-A and in Formulation:
  - Atmosphere Observing System (AOS-Storm and AOS-Sky)
  - Surface Biology and Geology (SBG)
  - Mass Change (MC)
- Surface Deformation and Change (SDC) remains in extended study phase, taking advantage of NISAR mission lessons learned.

**AOS**

MCR: May 2022  
KDP-A: Jan 2023

**SBG**

MCR: Jun 2022  
KDP-A: Nov 2022

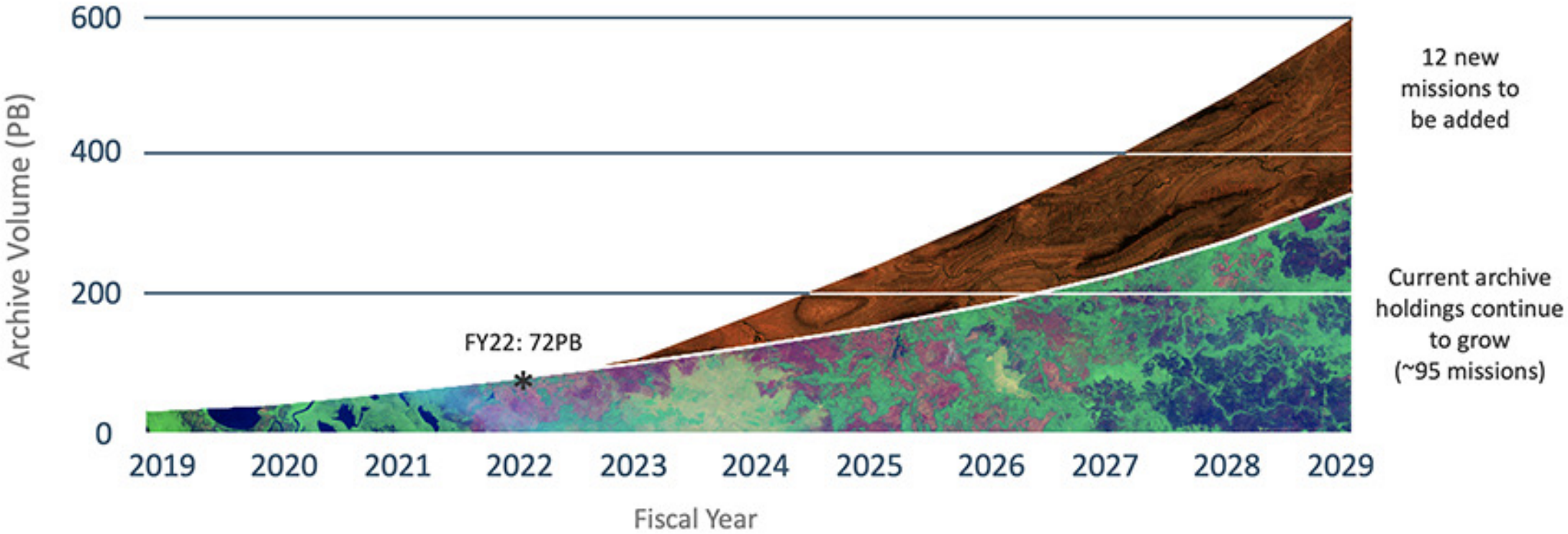
**MC**

MCR: Jun 2022  
KDP-A: March 2023

**SDC**

Remaining in extended  
Study Phase

# The Future of NASA Earth Science Data



Courtesy: ESDIS

# What is Open Science?

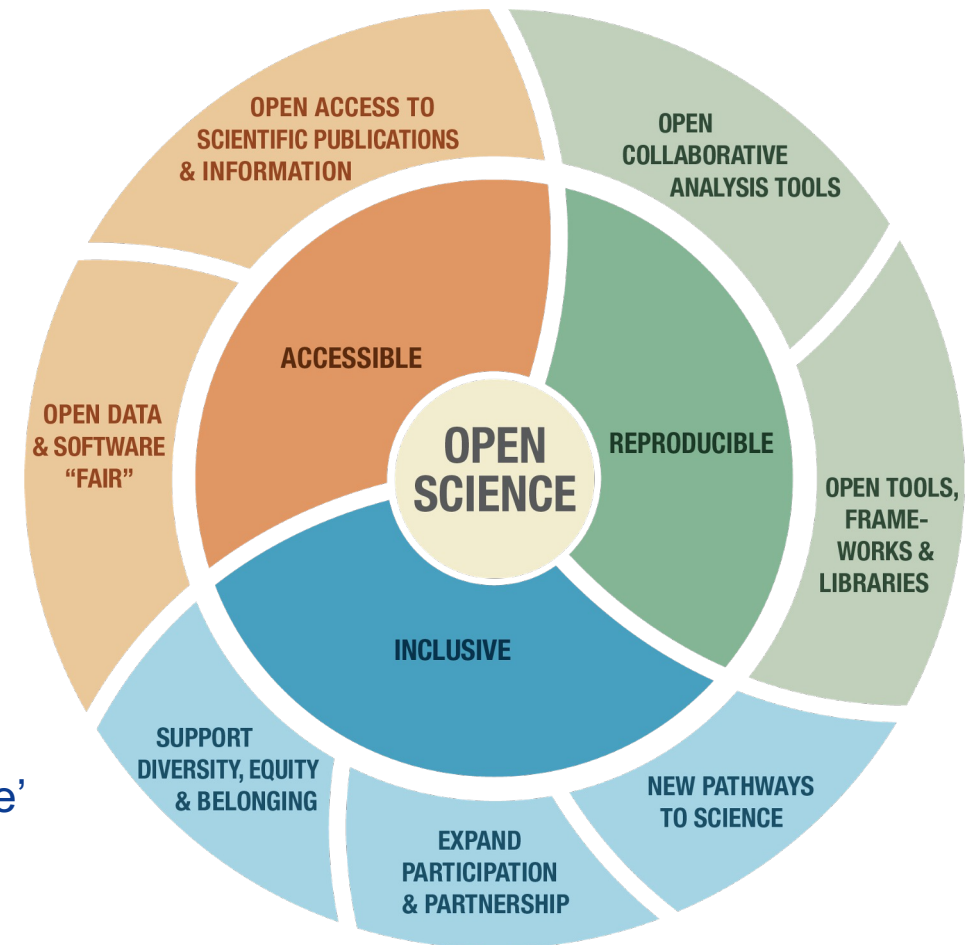
A collaborative culture enabled by technology that empowers the **open sharing of data, information, and knowledge** within the **scientific community and the wider public** to accelerate scientific research and understanding.

## Creates research that is:

- Cited more
- Has a bigger impact
- Increases transparency
- More inclusive

## Inclusive science means more:

- Collaborative projects
- Access to 'hidden knowledge'
- Equitable Systems
- Increased Participation



# The White House announces A Year of Open Science

NASA ♦ NSF ♦ NOAA ♦ DOE ♦ GSA ♦ NEH ♦ NIH ♦ USDA ♦ USGS (and more)

Open Science is the principle and practice of making research products and processes available to all, while respecting diverse cultures, maintaining security and privacy, and fostering collaborations, reproducibility, and equity.

2023 as a Year of Open Science is a multi-agency initiative across the federal government to spark change and inspire open science engagement through events and activities that will advance adoption of open science.



Learn more at:  
<https://open.science.gov/>



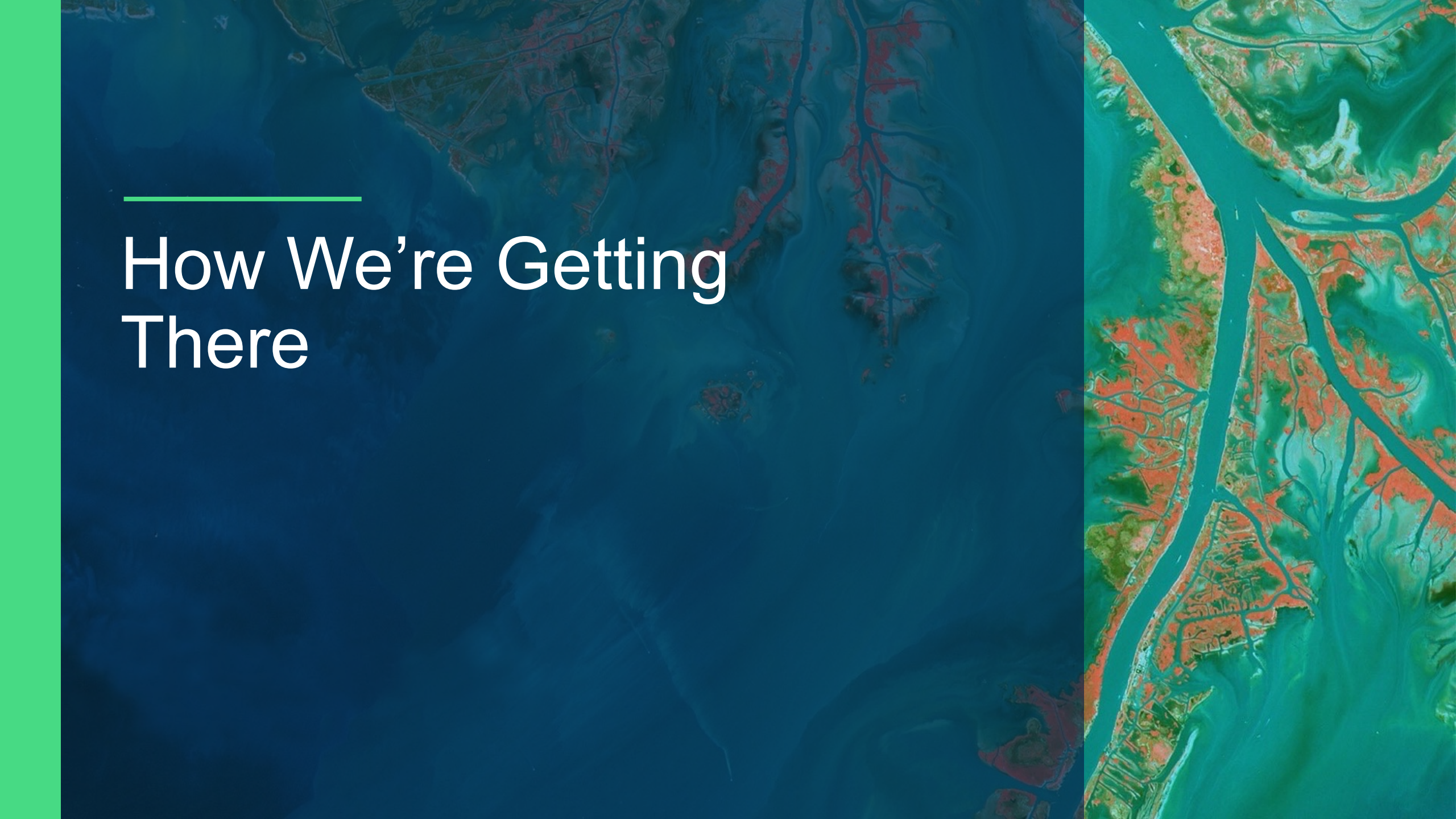
# *NASA Earth Science and Open-Source Science*

- **Open** the entirety of the scientific process, *from start to finish*
- **Broaden** and **diversify** community involvement in the scientific process
- Increase **accessibility** of data, software, & publications
- Facilitate inclusion, **transparency**, and **reproducibility** of science



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# How We're Getting There



# *ESDS Looking to the Future*



- Engaging with Open-Source Science Initiative (OSSI)
  - Policy, ***infrastructure***, funding, and ***community***
- Cloud Data & Compute
  - Future missions will leverage cloud data & compute
  - Multi-mission, cloud-based, open-source visualization and analytics platform (VEDA)

# *ESO Mission Data Processing Study*



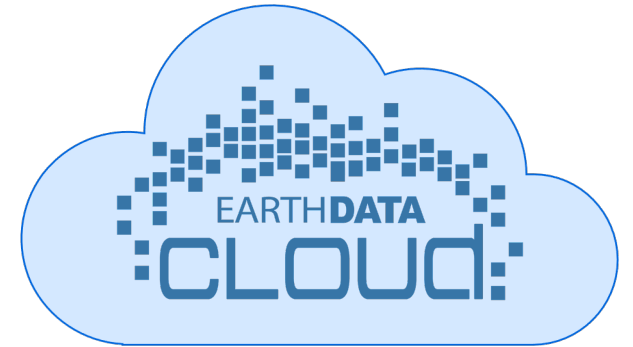
- **Goal:** Identify and assess potential architectures that can meet the ESO mission science processing objectives, enable data system efficiencies, promote open science principles, and seek opportunities that support Earth system science.
- **Led by** a Steering Committee and a System Architecture Working Group
- **Status:** Held 2 workshops. Conducted a trade study yielding architectural recommendations. **Report released in February 2023.**
- **Recommendations:**
  - Use a common service-based processing architecture across ESO missions
  - Deploy a multi-mission organization as the defined architecture with a set of common managed services (e.g., compute infrastructure, data cataloging and analysis services, a generic processing service, etc.)
  - Leverage industry-based protocols and specs





# Cloud Migration of Priority Earth Science Datasets

- Migration **increases the utility** of existing Earth Science datasets, by enabling NASA to **meet users' needs** for in-place computing, viz, and analysis as data volumes grow.
- The **top 75** most-downloaded datasets **migrated to Earthdata Cloud**.
  - Six (of twelve) DAACs were involved in this migration of data from local, on-premise hardware to Earthdata Cloud.
  - Migrated data were verified by the DAACs.
  - This was an imperceptible transition to many users.
- Two DAACs are **100% in the cloud** – GHRC and PO.DAAC.
- As of 3 May 2023, **2560+ collections** and **44+ Petabytes** of data are in Earthdata Cloud.



**Cloud migration continues to be a priority for NASA.  
All DAACs will participate.**

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# Visualization, Exploration, & Data Analysis (VEDA)

NASA's Cloud-based, Open-Source, Earth Science, Multi-Mission Analytics Platform



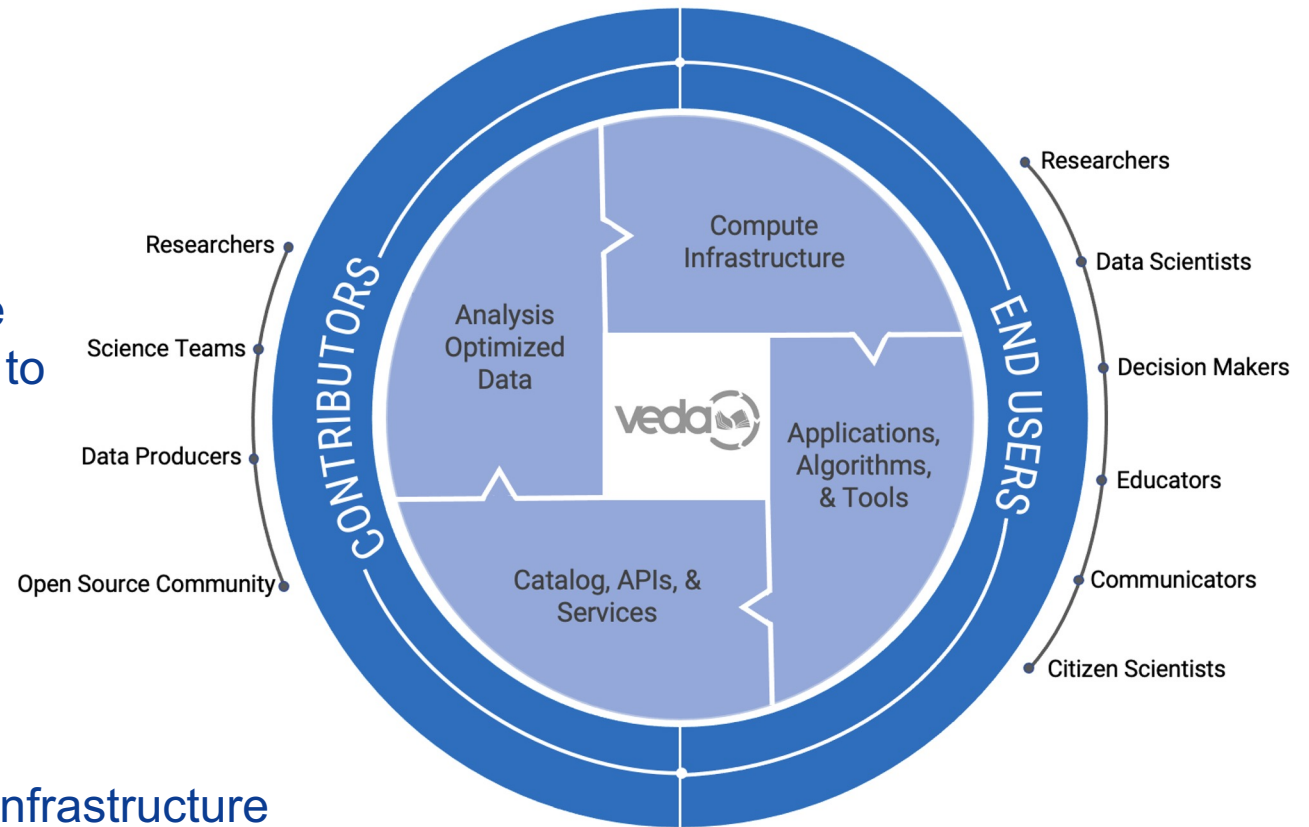
# VEDA Highlights

## Why?

- Interdisciplinary science depends on large amount of Earth science data and access to advanced computational resources
- Working with these datasets is non-trivial
- Big data science requires advanced distributed computing knowledge

## What?

- Open-source science multi-mission cyberinfrastructure
- In-place cloud-native data processing, analysis, visualization, and exploration
- User-friendly scientific discovery via an accessible and reproducible computation framework
- Builds upon a robust heritage of existing NASA technology, promoting interoperability

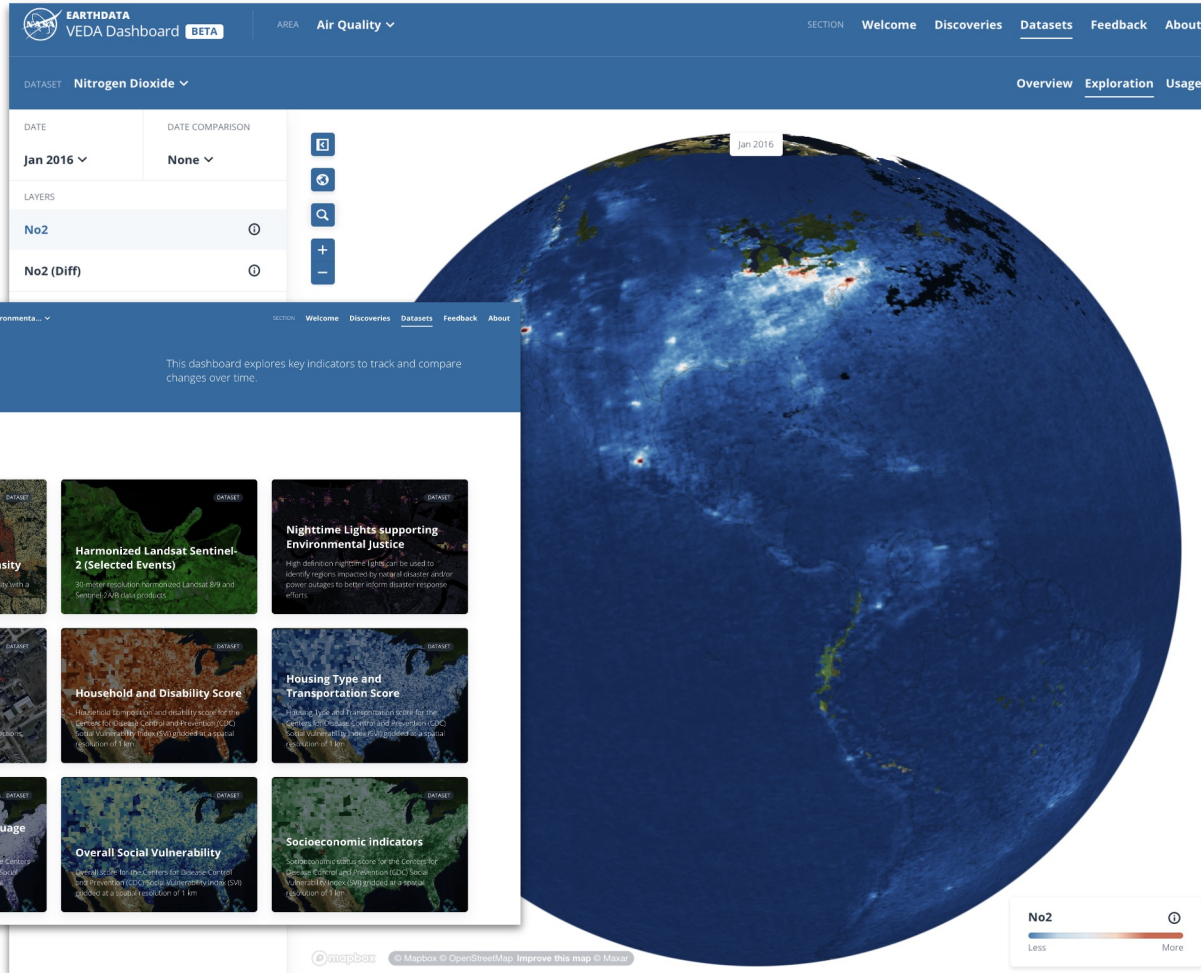


Explore

Analyze

Publish

Communicate



- Finding relevant data products
- Exploring data to identify interesting features



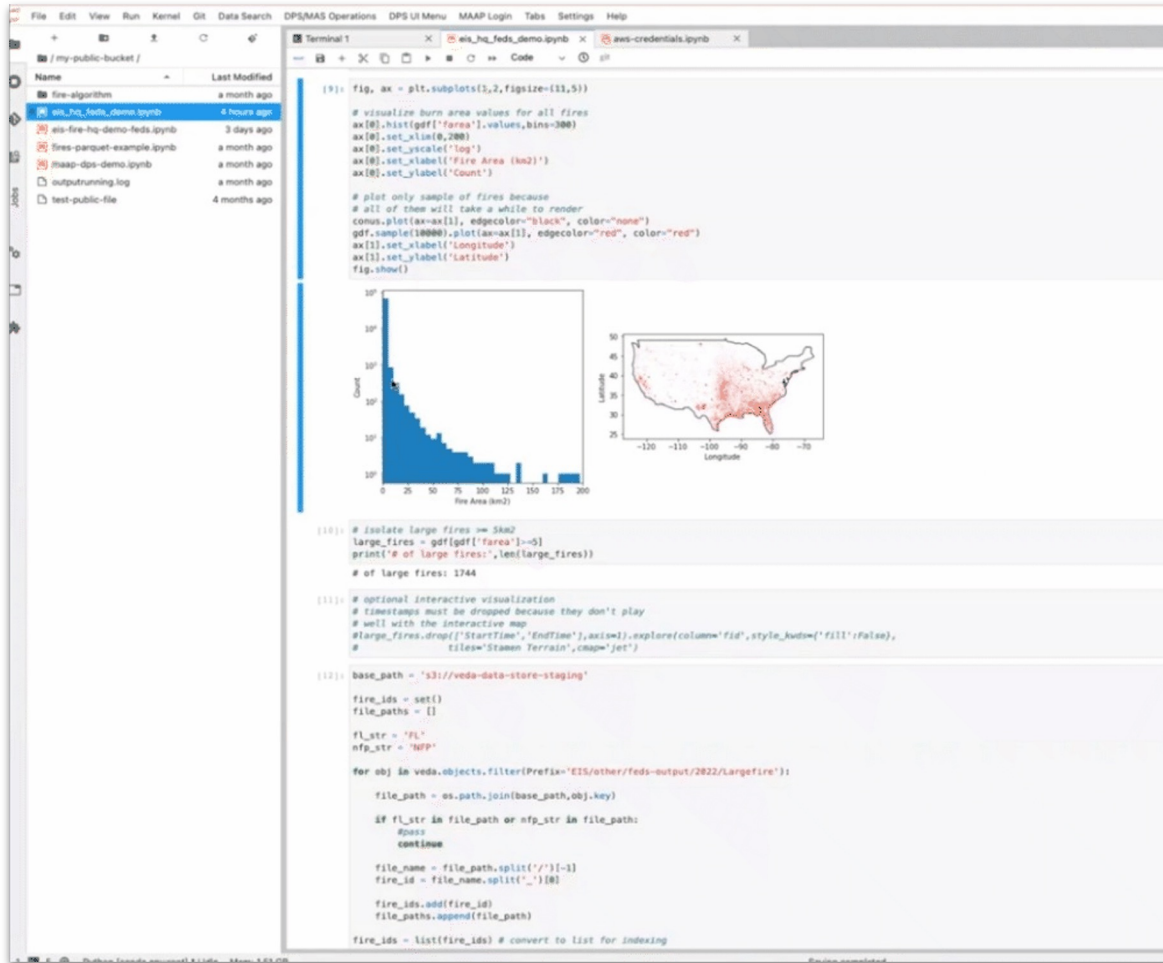
[VEDA Dashboard on NASA Earthdata](#)

Explore

Analyze

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Communicate



- Developing advanced data products and analysis
- Carrying out calculations "in place" without the need to download data
- Dynamically allocating resources for computationally demanding processing

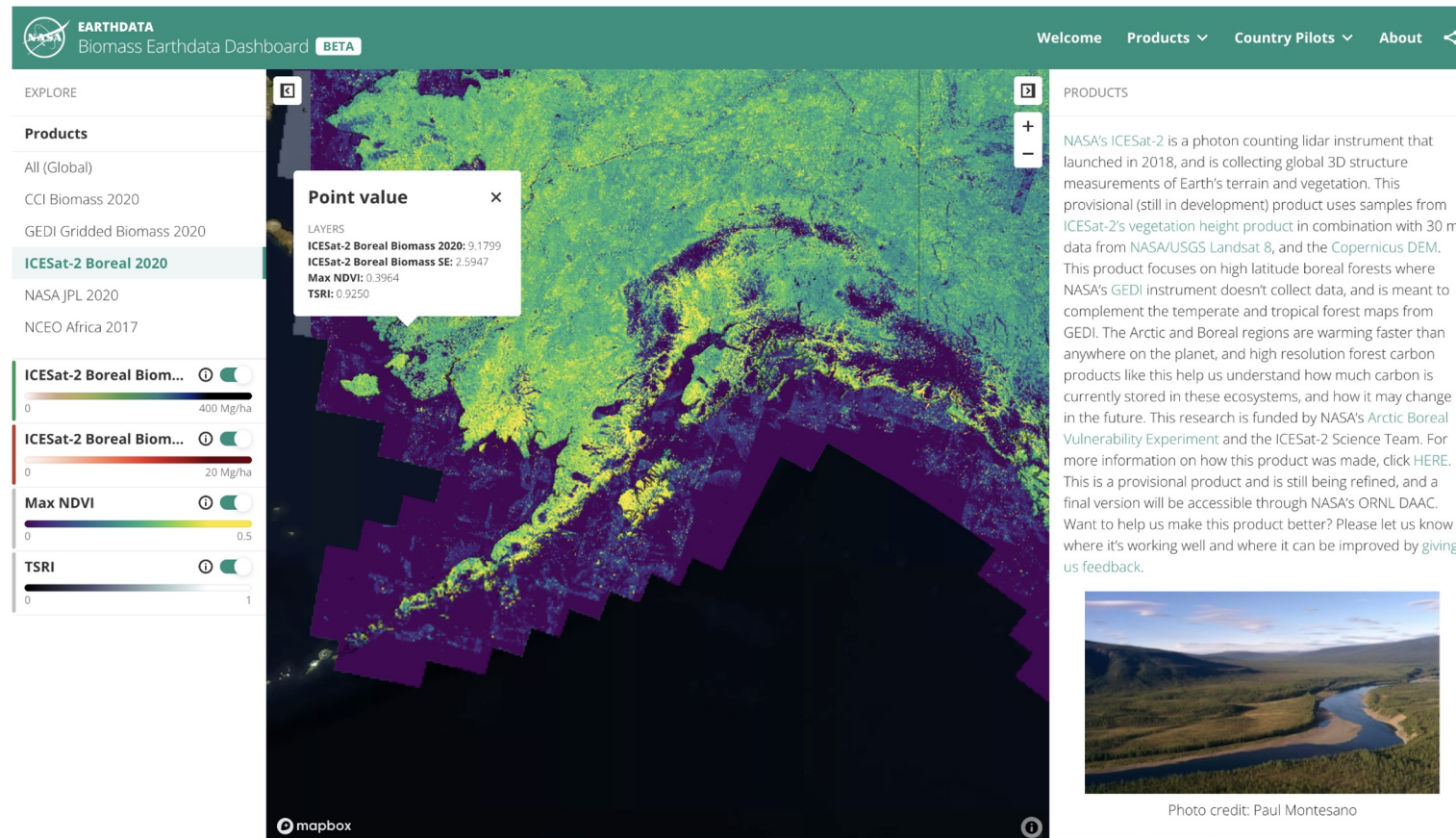


Explore

Analyze

Publish

Communicate



- Conveniently delivering data through existing interfaces
- Providing automatic access to interactive visualization capabilities
- Allowing users to analyze other's products within the environment

Explore

Analyze

Publish

Communicate

The screenshot shows the EARTHDATA VEDA Dashboard interface. At the top, there is a navigation bar with the NASA logo, 'EARTHDATA VEDA Dashboard BETA', and a dropdown menu for 'AREA: Environmenta...'. To the right, there are links for 'SECTION: Welcome', 'Discoveries', 'Datasets', 'Feedback', and 'About'. Below the navigation bar, a blue banner displays the title 'Connecting Disaster Recovery with Environmental Justice' and a sub-header 'Featuring Hurricane María and Hurricane Ida'. The main content area contains two sections of text. The first section is titled 'Connecting Disaster Recovery with Environmental Justice: Hurricane María' and describes the impact of Hurricane María on Puerto Rico in 2017, highlighting the challenges faced by lower socioeconomic communities. The second section is titled 'Connecting Disaster Recovery with Environmental Justice: Hurricane Ida' and discusses the impact of Hurricane Ida on New Orleans in 2021, emphasizing the need for better disaster preparedness and response for disadvantaged communities.

- User friendly and more engaging data-driven storytelling
- Enrich science and applications narratives with interactive exploration

# *ESDS Looking to the Future*



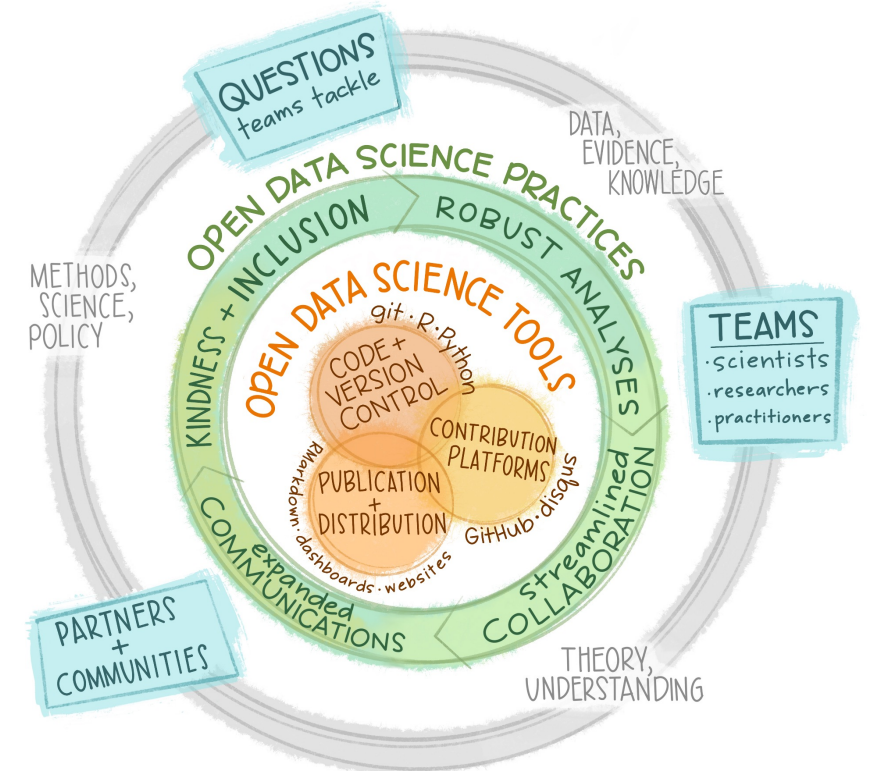
**Bottom line:** ESDS Program elements and stewards of NASA Earth Science data will...

- Be trained to be ***user-facing*** advocates, communicators, and facilitators of ***open-source science***
- Maintain the tools, services, and software necessary for science communities to ***conduct science in the cloud***



# NASA Openscapes

- Multi-year activity to
  - Accelerate data-driven solutions
  - Increase diversity, equity, inclusion, and belonging in research and beyond
- By deploying the Openscapes movement building methodology within NASA DAACs
  - Champions program
  - Collecting and sharing resources, knowledge, workflows, and skills



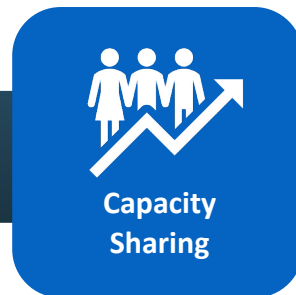
<https://nasa-openscapes.github.io/>

# NASA Transform to Open Science (TOPS)

A \$40 million, 5-year mission to accelerate adoption of Open Science

## Strategic Goals:

- Support 20K researchers to earn NASA's Open Science badge
- Double the participation of historically excluded groups across NASA science
- Enable five major scientific discoveries through open science principles



*Join us in 2023 as a  
Year of Open Science  
with NASA TOPS!*

# Why get a NASA Open Science Certification?

Designed to provide researchers with **core open science skills**:

- Discover the digital tools and resources to perform open science (e.g., GitHub, ORCID)
- Learn best practices for data and software management
- Connect with communities of open science practitioners

***TOPS Open Science 101** – a community-developed curriculum to open science built upon inclusivity, accessibility, and diversity.*



[Learn More](#)



# *NASA Commitment to Equity & Environmental Justice*

**Diversify Earth science research and applications** with representation from all backgrounds.

**Support Equity and Environmental Justice (EEJ) communities** by growing the awareness, accessibility, and use of Earth science data, research, and applications for a broad array of users.

NASA ESD supports EEJ through a variety of activities – notable programs are **UNBOUND**, **Citizen Science**, and **Applied Science's EEJ** program.



# Take-Home Points

- The Landscape
  - NASA has upcoming missions with big data challenges
  - NASA user communities are broadening and expanding
- Science in the cloud is priority for NASA
  - Future missions will be leveraging cloud data and compute
  - Valuable heritage datasets will be migrated to Earthdata Cloud and transformed into ARCO formats to support interoperability and in-place analysis
- NASA is committed to **open-source science** and to promoting equity & environmental justice
  - Open-source science will **accelerate** scientific discovery, will **broaden** and **diversify** our user communities, and will increase **transparency** and **reproducibility** of our science
  - **TOPS** and **Openscapes** are community- and DAAC-oriented activities to achieve open source science, respectively

A satellite view of Earth from space, showing the Western Hemisphere. The image is dominated by a large, semi-transparent blue rectangular overlay that covers most of the frame. This blue area is enclosed by a thin red border. In the center of this blue area, the words "Thank You!" are written in a clean, white, sans-serif font. The background shows the Earth's surface with various shades of blue, green, and brown, representing oceans, landmasses, and clouds. The top and bottom edges of the image show the curvature of the planet and the blackness of space.

Thank You!