National Aeronautics and Space Administration

EARTHDATA

NASA Agency Report

WGISS-59 3/24-28/2025

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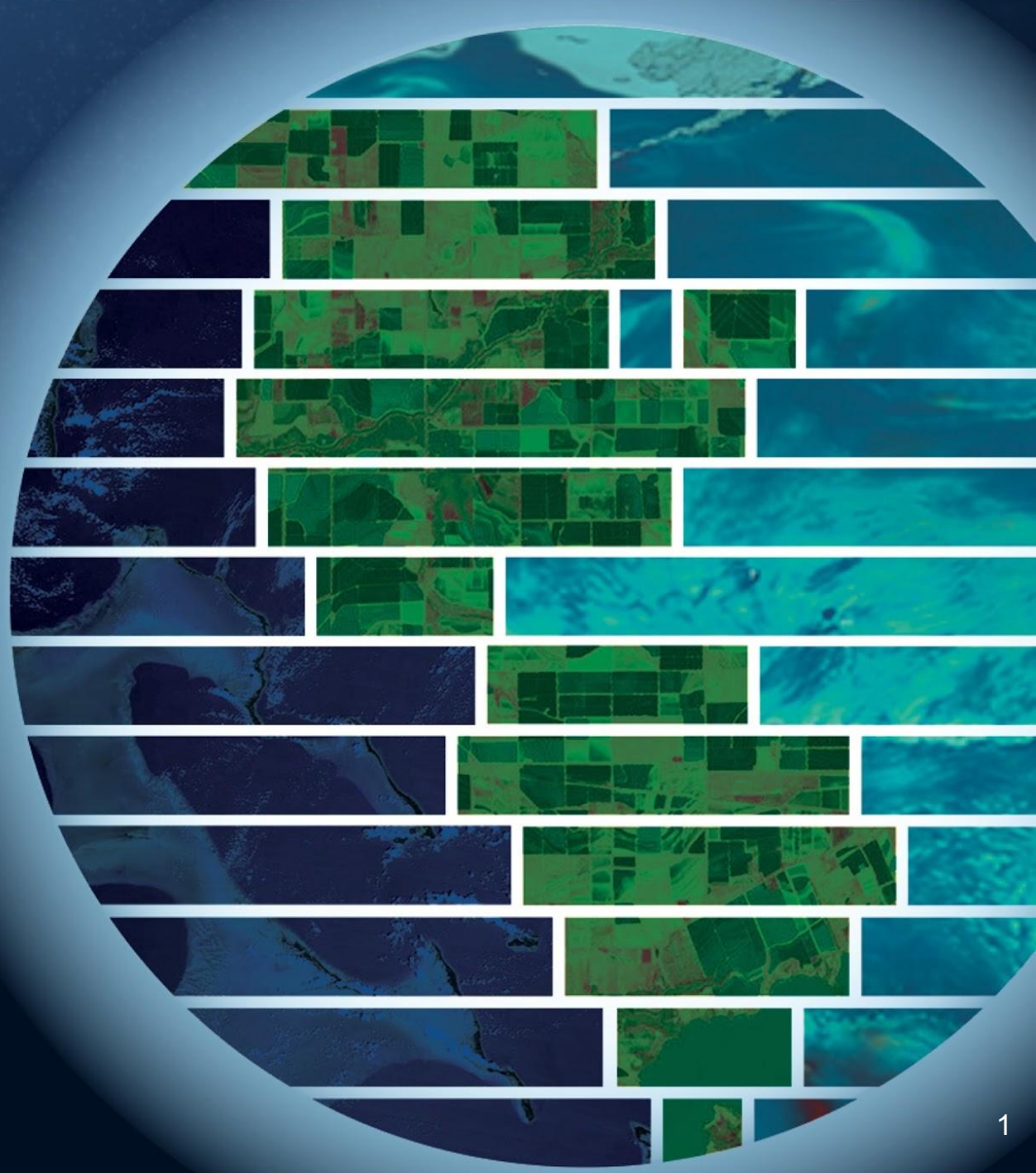
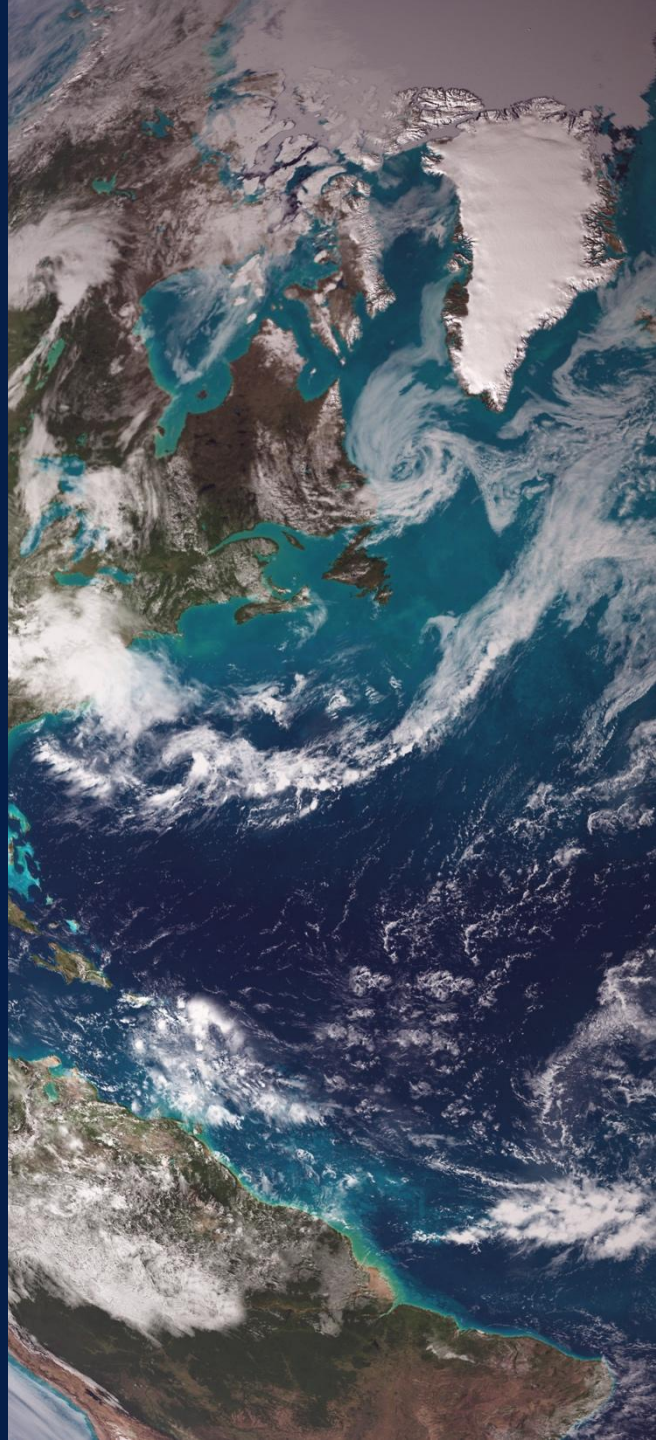
NASA ESDIS Project, Goddard Space Flight Center



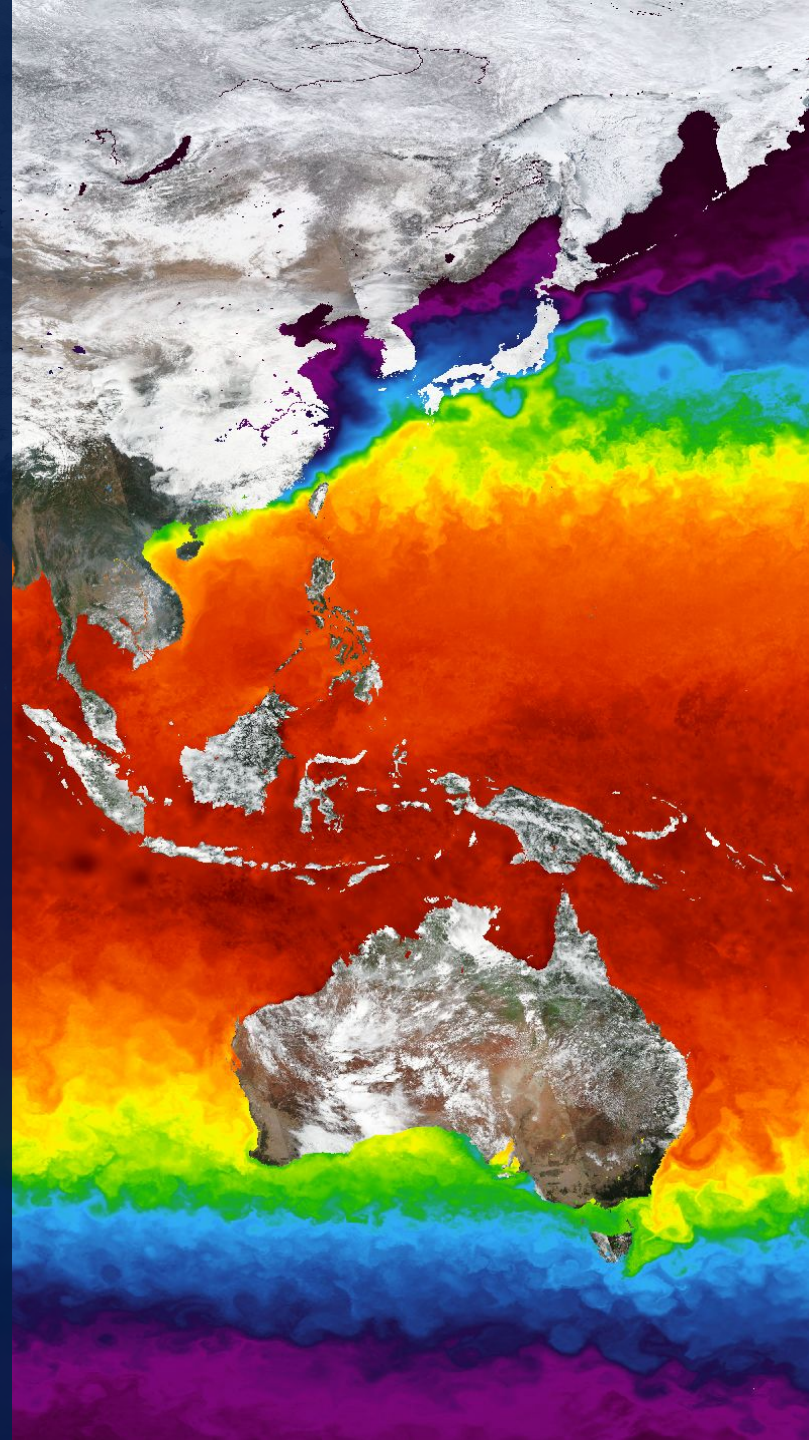
Agenda

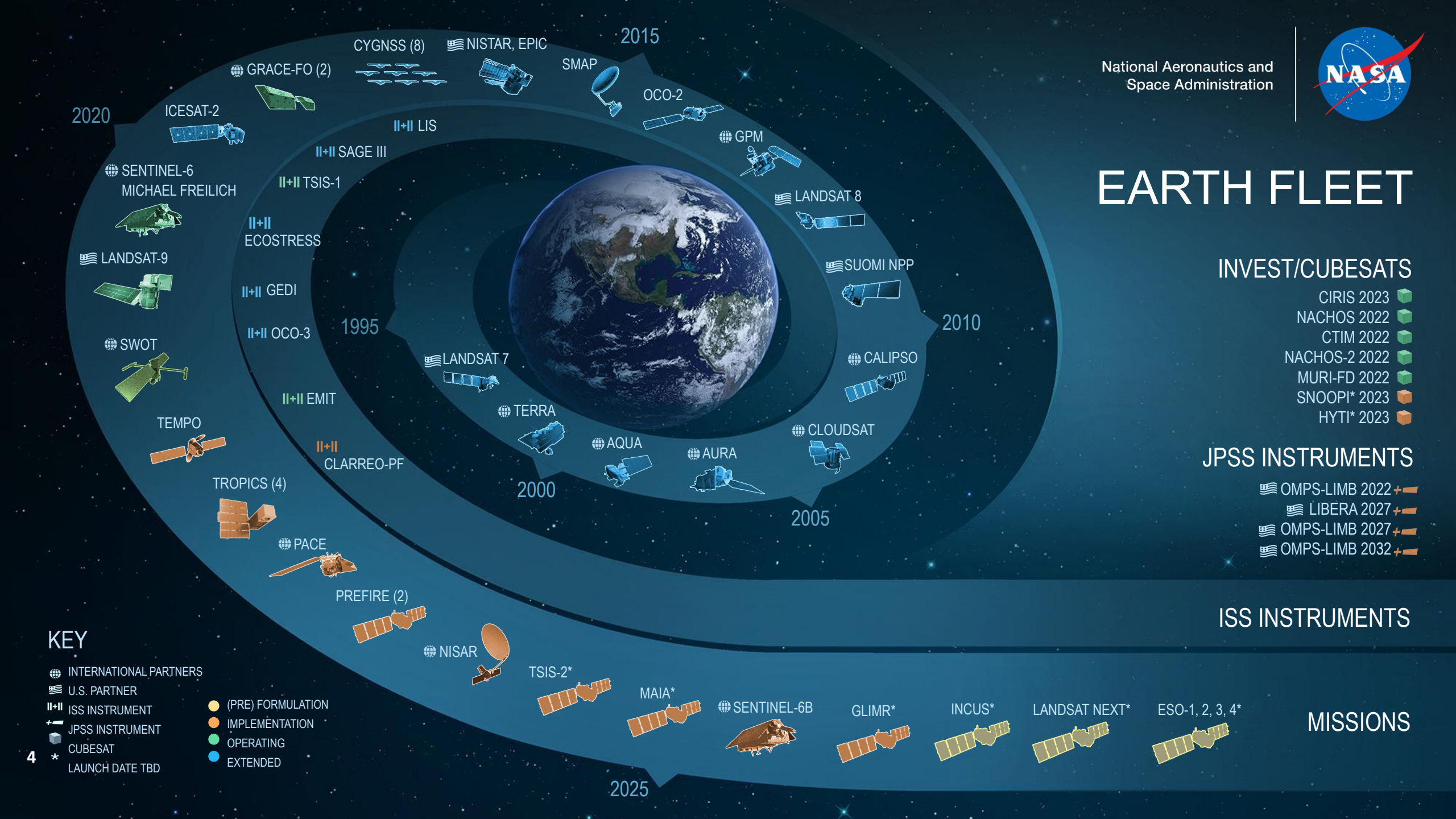
- Current & future state
- Cloud migration
- Focusing on user needs
- Consolidation of tools and services



Current & future state

Where we are today and where we are going

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NASA
EARTH FLEET
2015
2020
1995
2010
2000
2005
2025
CYGNSS (8)
NISTAR, EPIC
SMAP
OCO-2
GRACE-FO (2)
ICESAT-2
LIS
GPM
SAGE III
SENTINEL-6 MICHAEL FREILICH
TSIS-1
LANDSAT 8
ECOSTRESS
LANDSAT-9
SUOMI NPP
GEDI
OCO-3
SWOT
LANDSAT 7
CALIPSO
EMIT
TERRA
TEMPO
AQUA
AURA
CLOUDSAT
CLARREO-PF
TROPICS (4)
PACE
PREFIRE (2)
NISAR
TSIS-2*
MAIA*
SENTINEL-6B
GLIMR*
INCUS*
LANDSAT NEXT*
ESO-1, 2, 3, 4*
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

DATA ARCHIVE SUMMARY

FY 24

End User Average Distribution Volume FY24 (unofficial)
~450 TB/Day

End User Distribution Files including from Cloud FY24
~4.5 Billion

Total Archive Volume Including in Cloud
128.6 PB

Website Sessions (Google Analytics)
3.5 Million

Average Archive Growth
147.3 TB/Day

EOSDIS Customer Satisfaction Index Score (2024)
78

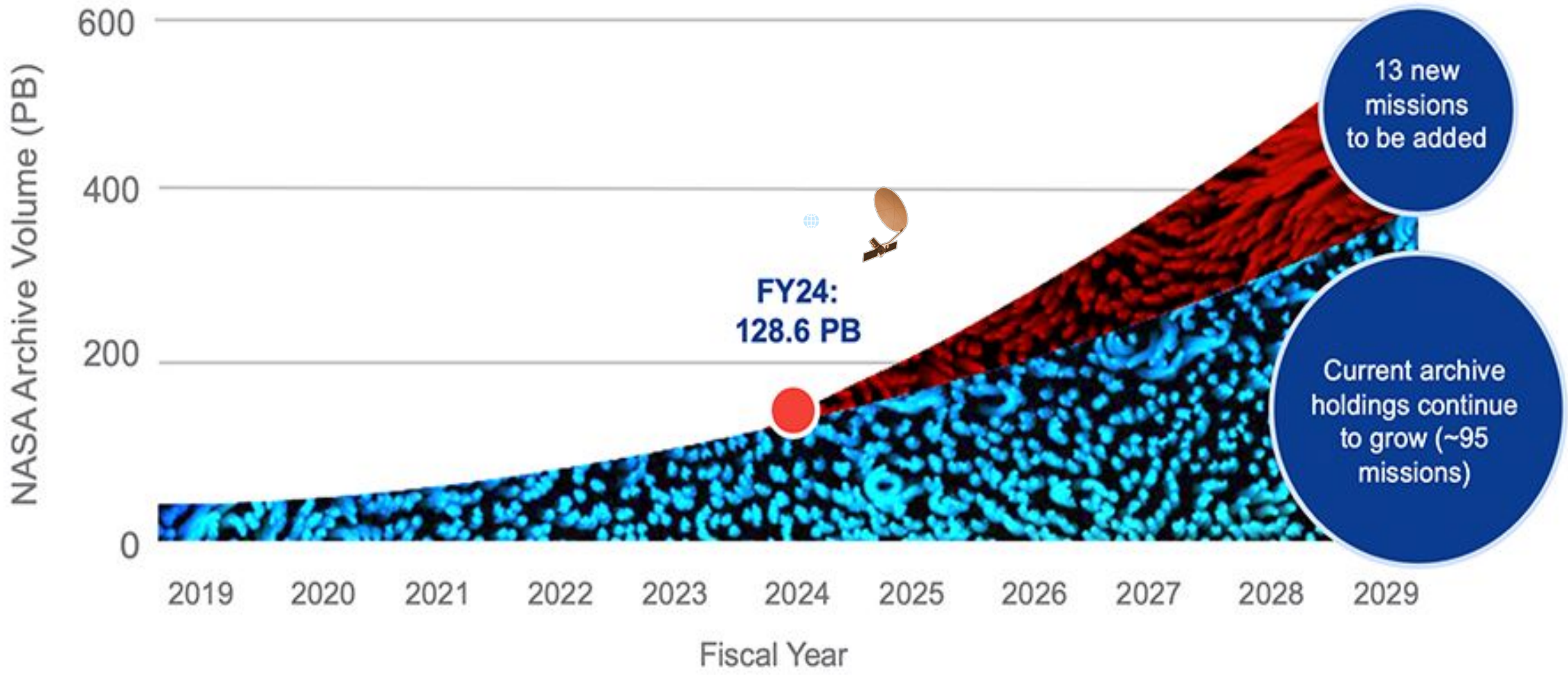
Total Archive Volume In Cloud Only FY24 (unofficial)
66.7 PB

Total Number of Files
Over 3.8 Billion

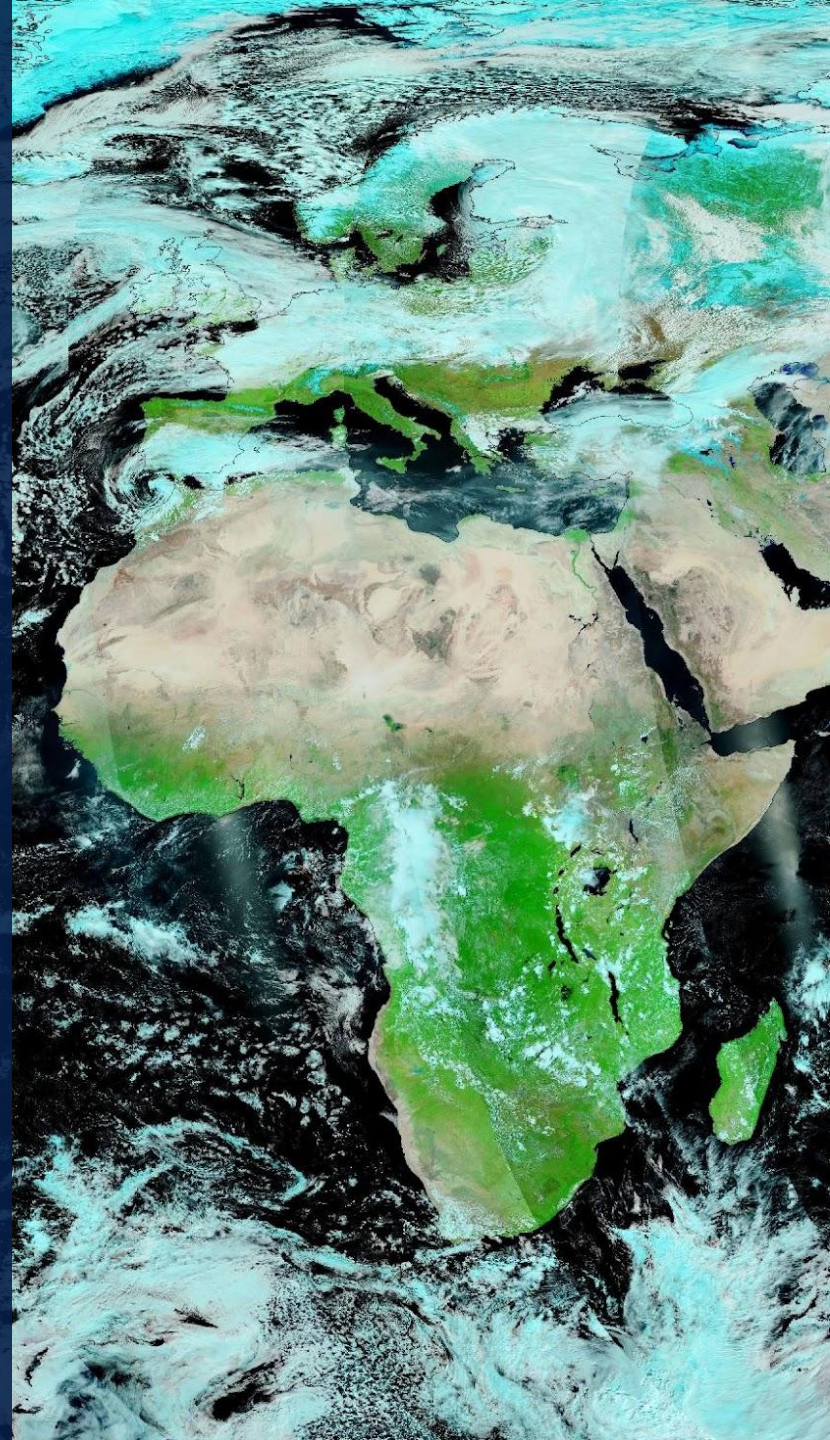
Unique Datasets
17,496
Collections in Cloud
5,595+

Distinct Users of EOSDIS Data & Services (Google Analytics)
8.4 Million

Earth Science Data Archive Growth Projection



Cloud migration



The primary goal of cloud migration is…

User access to data, adjacent to high performance compute

The details

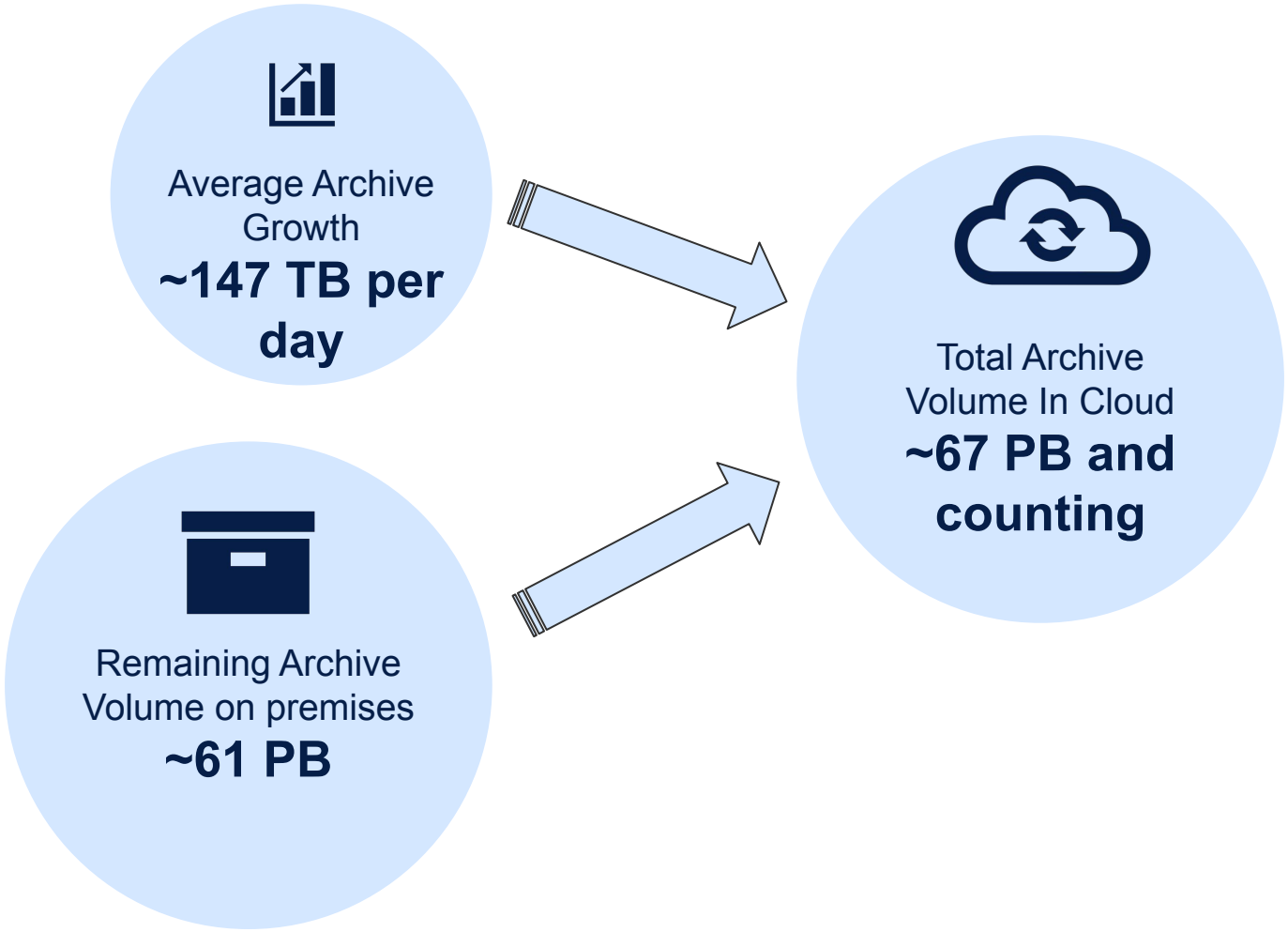
66.7Pb of data in Amazon Web Services, **S3**

Region: **US-WEST-2**

Access: **S3 API** and **HTTPS**

Discovery: **STAC and CMR APIs, Earthdata Search UI**

Progress



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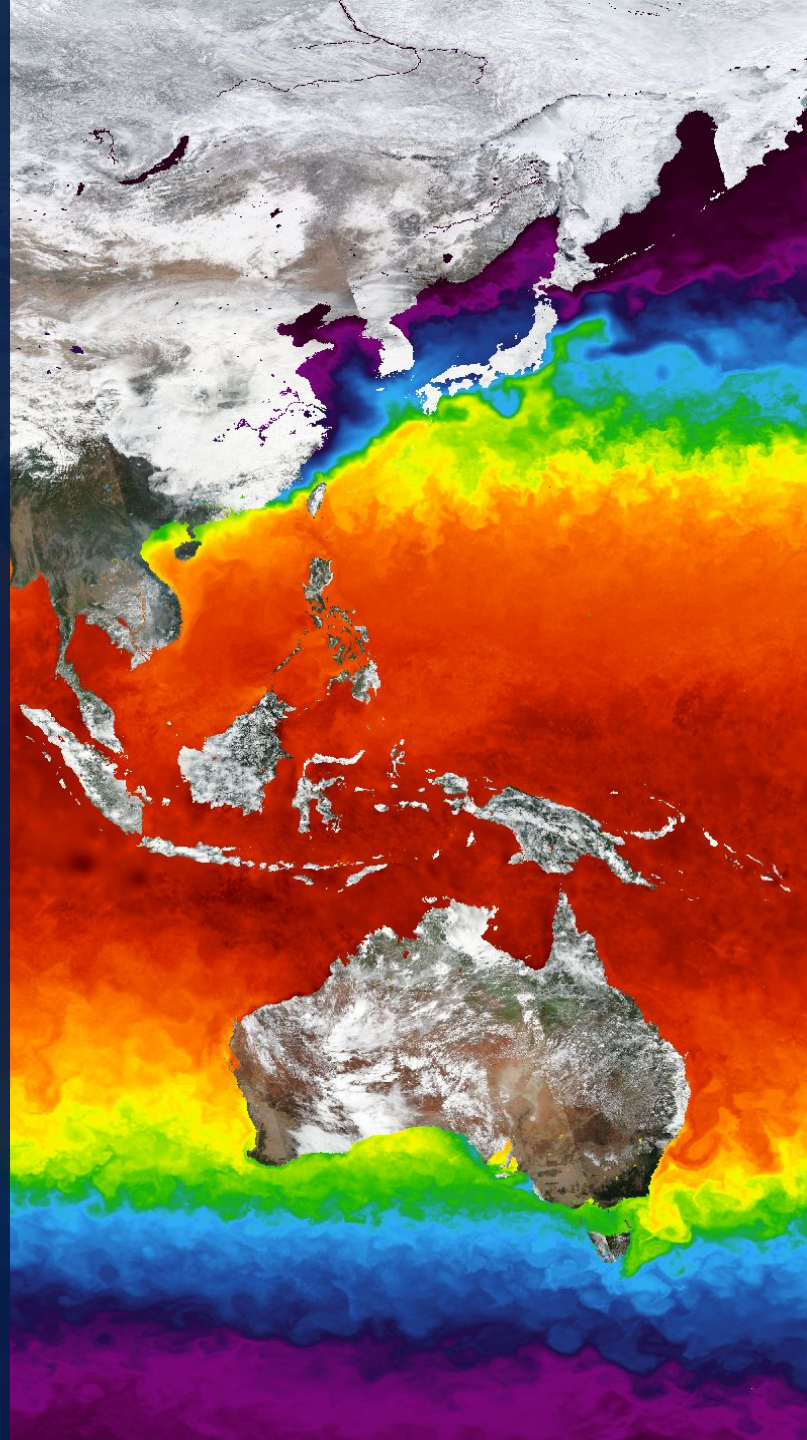
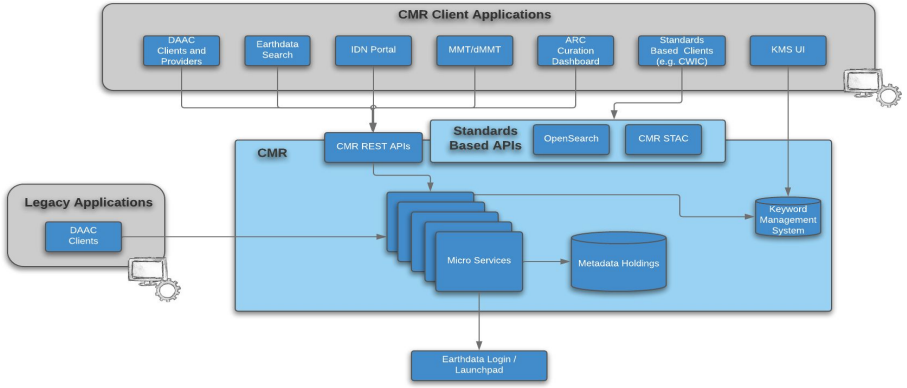
A focus on user needs

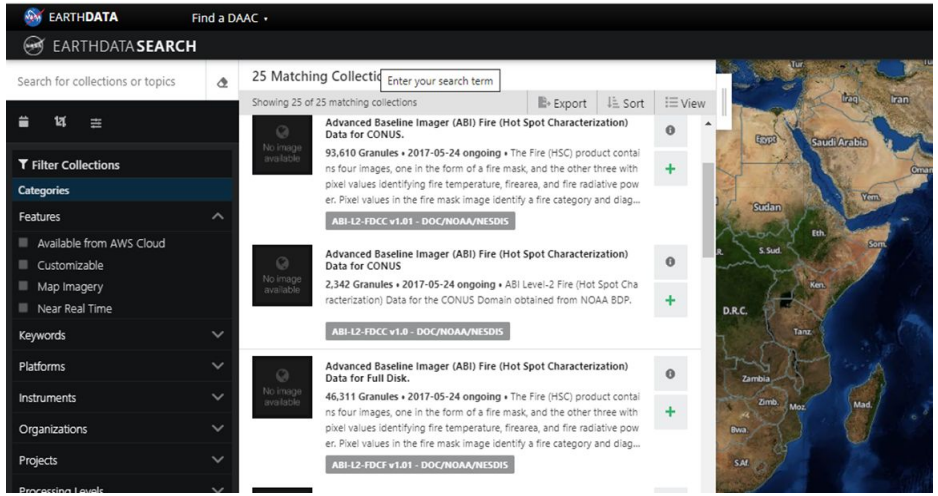


Data discovery - CMR & Earthdata Search

CMR is a high-performance, high-quality, continuously evolving metadata system that catalogs Earth Science data and associated service metadata records. These metadata records are registered, modified, discovered, and accessed through programmatic interfaces leveraging standard protocols and APIs.

Earthdata Search is a search client, backed by the Common Metadata Repository (CMR), whose primary goal is to be a means for end-users (usually scientists and students) to discover, visualize, refine, and access earth science data.





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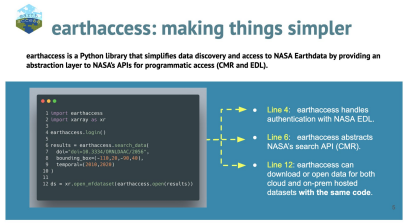
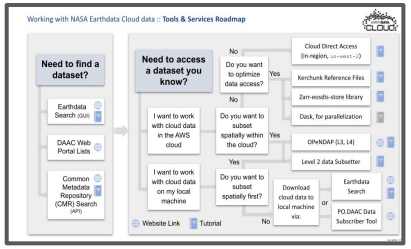
Data discovery & use - Openscapes

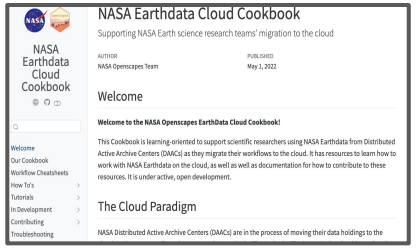
Openscapes supports scientists using data from NASA Earthdata served from the DAACs as they migrate workflows to the cloud, easing the discovery, access and usage of NASA Earth Science data.

- Software - EarthAccess

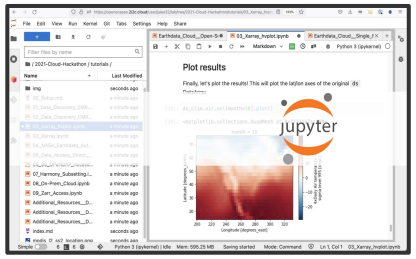


- Workshops, tutorials and mentoring from science community members





- Cloud-based development environments - 2i2c Jupyter Hubs





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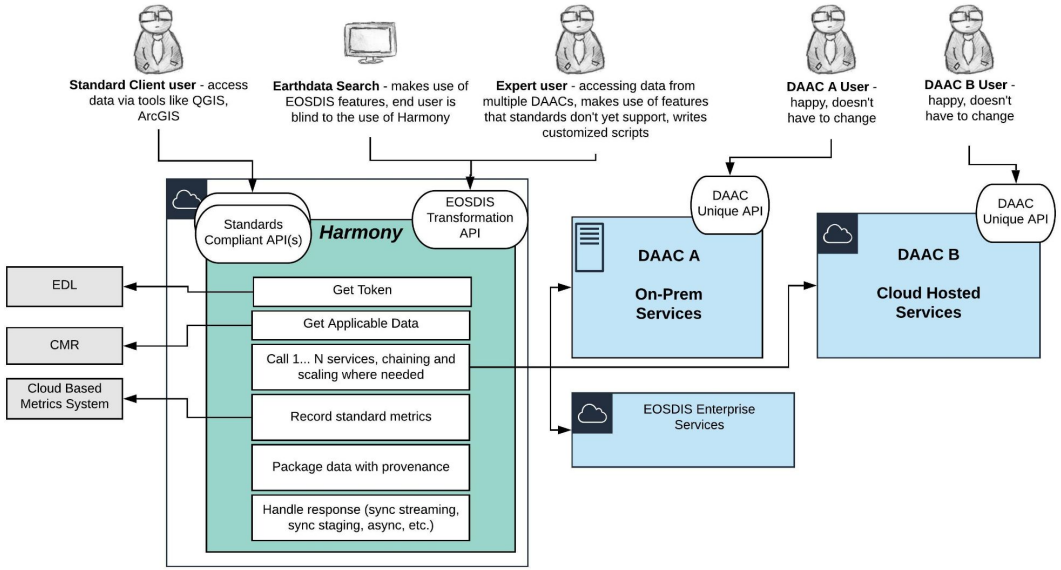
Data transformation - Harmony

Harmony is NASA ESDIS' cloud based, open-source, data transformation platform. It provides unified access to data products and services across various earth science disciplines.

- **Open and Shared:** Code for Harmony and its services are open source, enabling transparency, code shareability, and cross-team contributions.
- **Evolving Standards**: architected to adhere to widely used standards like OGC and STAC.
- **Leveraging the Cloud**: takes full advantage of the cloud and native technologies, leading to better scalability and reliability in the face of growing data volumes.
- **Unified Access:** leverages several earth science data systems but provides those capabilities in a uniform manner



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Data Visualization - Worldview

Worldview is a visualization user interface for over 1000 global, full-resolution satellite imagery layers, allowing users to visualize and then download the underlying data.

Worldview is integrated into NASA's Earth Information Center Hyperwall exhibits at NASA Head Quarters, The Smithsonian Natural History Museum and earth.gov

In 2023, Worldview served more than 5000 unique users with 10,000 daily page views. It was cited in over 300 journal and news articles.



NASA Administrator Bill Nelson at the NASA Earth Information Center Hyperwall. This installation contains live Worldview instances of recently-acquired satellite imagery.

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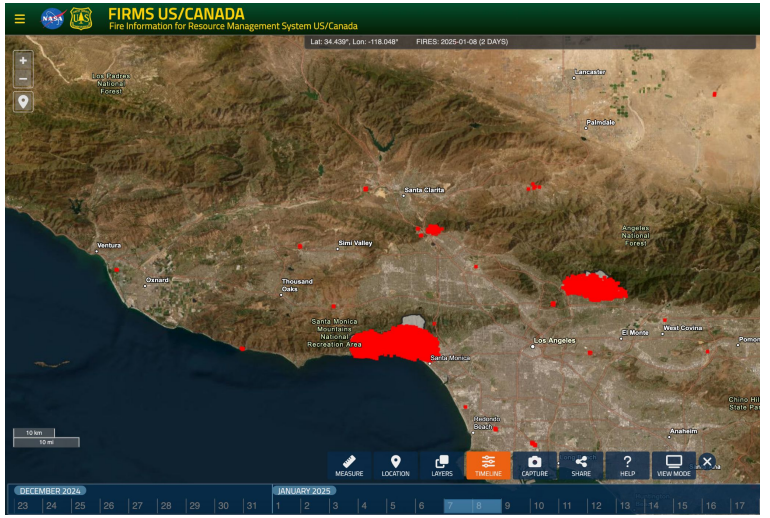
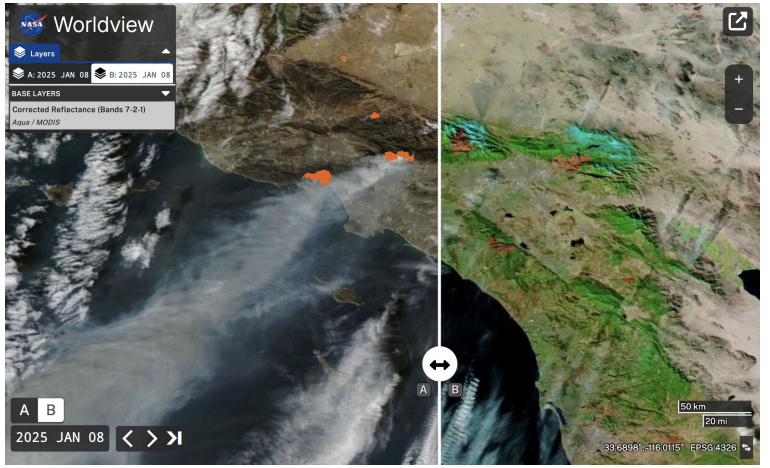
Data Visualization - FIRMS

The **Fire Information for Resource Management System** (FIRMS) distributes Near Real-Time (NRT) active fire data as part of the NASA's Land, Atmosphere Near real-time Capability for Earth observation (LANCE). Globally these data are available within 3 hours of satellite observation, but for the US and Canada active fire detections are available in real-time.

In 2023, FIRMS served more than 3.8 million users from over 180 countries, over 13 million pageviews. On average FIRMS sends out 70,000 fire alerts per day. During the California Wildfires of 2025 FIRMS was received more page views than any other NASA site.





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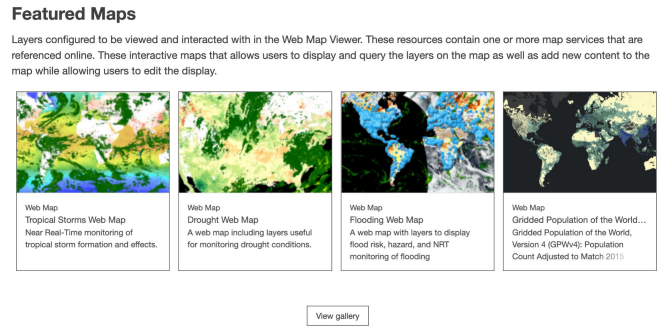
Data visualization - EGIS

In 2022, after examining NASA's annual American Customer Satisfaction Index results, it became clear that NASA needed to provide support for our users in the ESRI/ArcGIS ecosystem.

	2022 (%)
Tool used to work with data ~~	
ArcGIS	61%
Quantum GIS (QGIS)	45%
Excel	30%
ENVI	24%
Other/open source	23%



[EGIS](), the Earthdata Geospatial Information system, provides

- ArcGIS & OGC-compliant raster & feature services
- Map layers, Story maps, Web maps, Map applications

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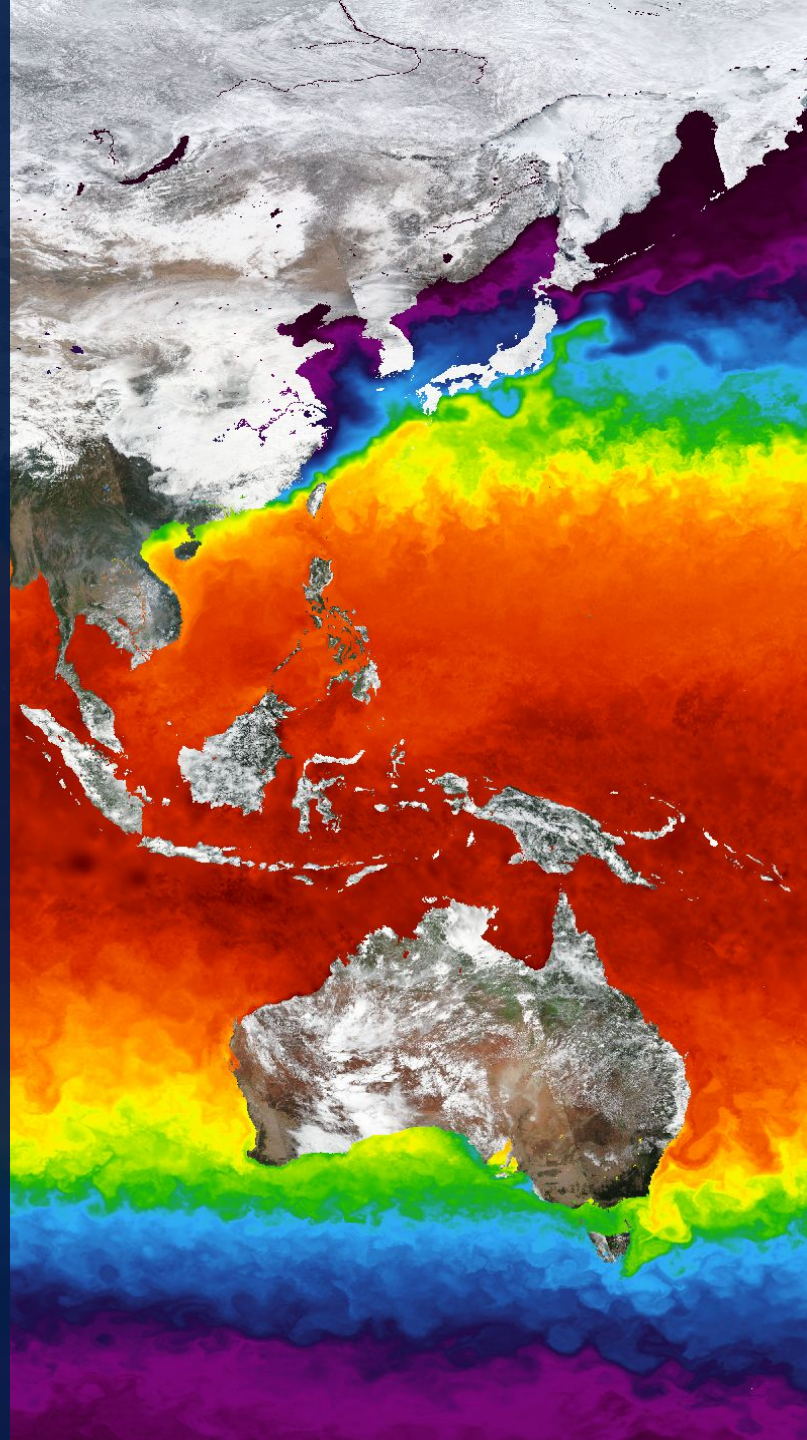
Consolidation of tools and services



Web unification & Service de-duplication

Web Unification

Unifies all ESDS-funded public facing web properties into earthdata

Ensures common look and feel across content

Compliance with the IDEA Act

+

Service Deduplication

Identify areas of overlap between existing tools and services and converge where possible

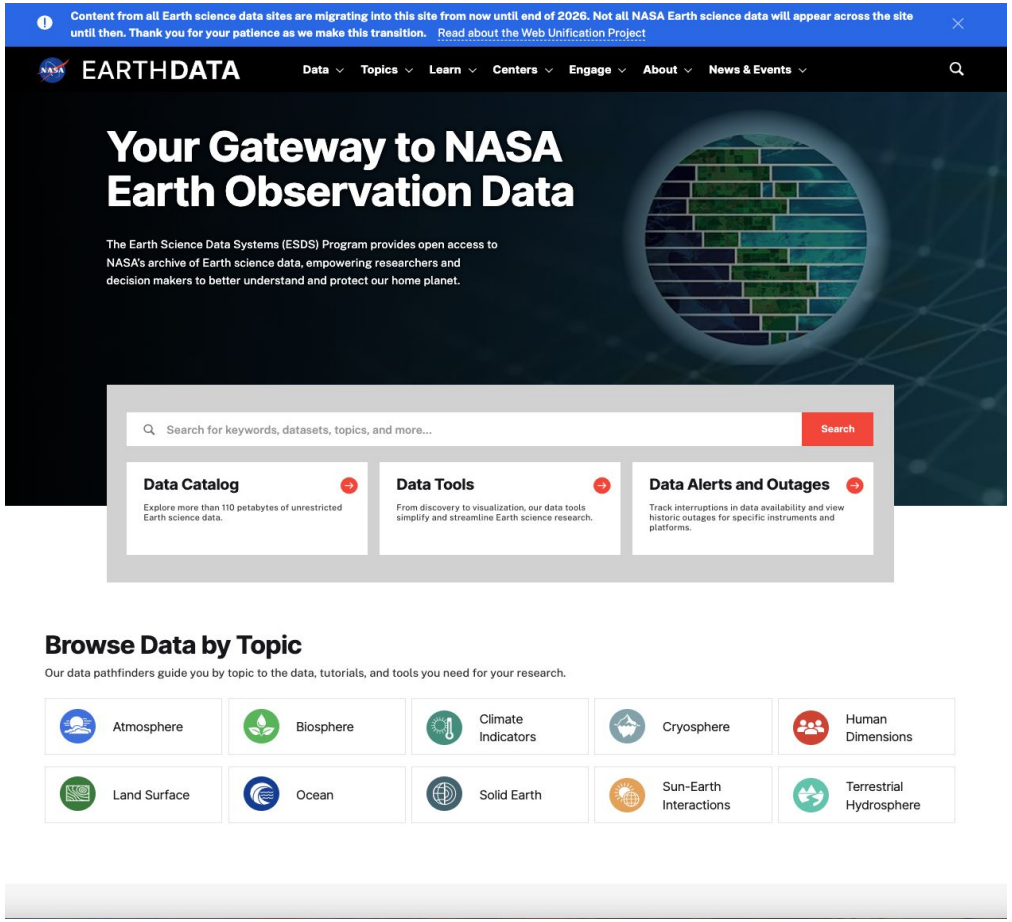
Maintain as much value as possible for unique user communities

→

Simpler, more coherent set of information and tooling for engaging with NASA Earth data

Reduced infrastructure and maintenance for NASA

Web Unification



https://earthdata.nasa.gov

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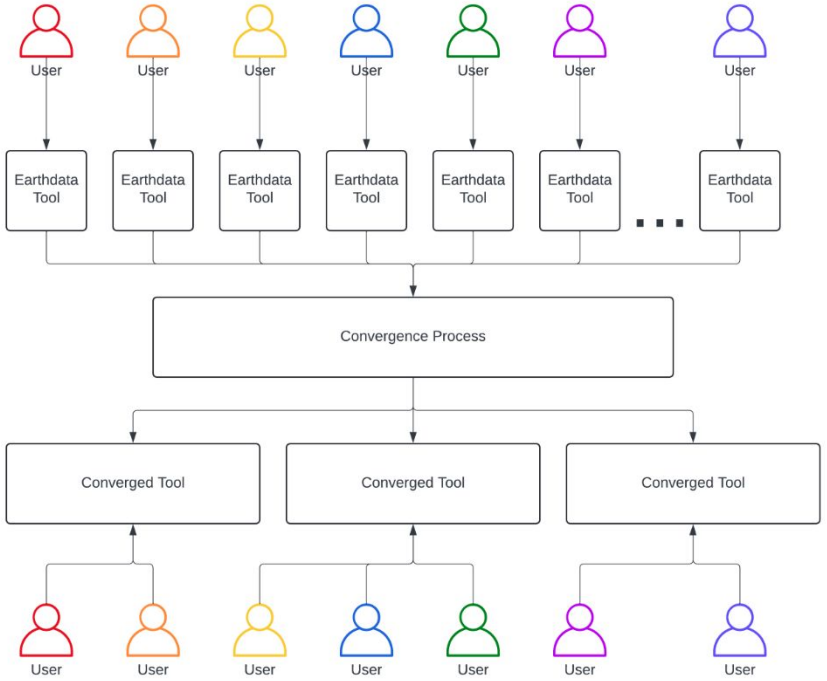
Service de-duplication



No. of converged tools/services < No. of original tools/services

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Ingest & Archive - SIA

The past: data is archived, on-premises, at twelve archive centers (DAACs)

The present: **Cumulus**: data is archived in the cloud but infrastructure and data is distributed across multiple tenants and managed by our DAACs

The future: **Service for Ingest & Archive** (SIA) centralized, enterprise archive

SIA will be ‘a world-class, forward-looking, cost-efficient data archive system for Earth Science’

Status: planning and requirements development

Processing - Harmony

The past: A consolidation of various enterprise-level data processing services, using standards-based, OGC-inspired APIs.

The present: Integration of GES DISC processing functionality represented in Giovanni.

The future: Integration of processing capabilities from other DAACs. For example,

- HyP3 SAR processing - Alaska SAR Facility
- AppEEARS - Land Processes DAAC

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Thank you

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