



# NASA-ESA-OGC Open Science Persistent Demonstrator

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# Value of Open Science and Innovation

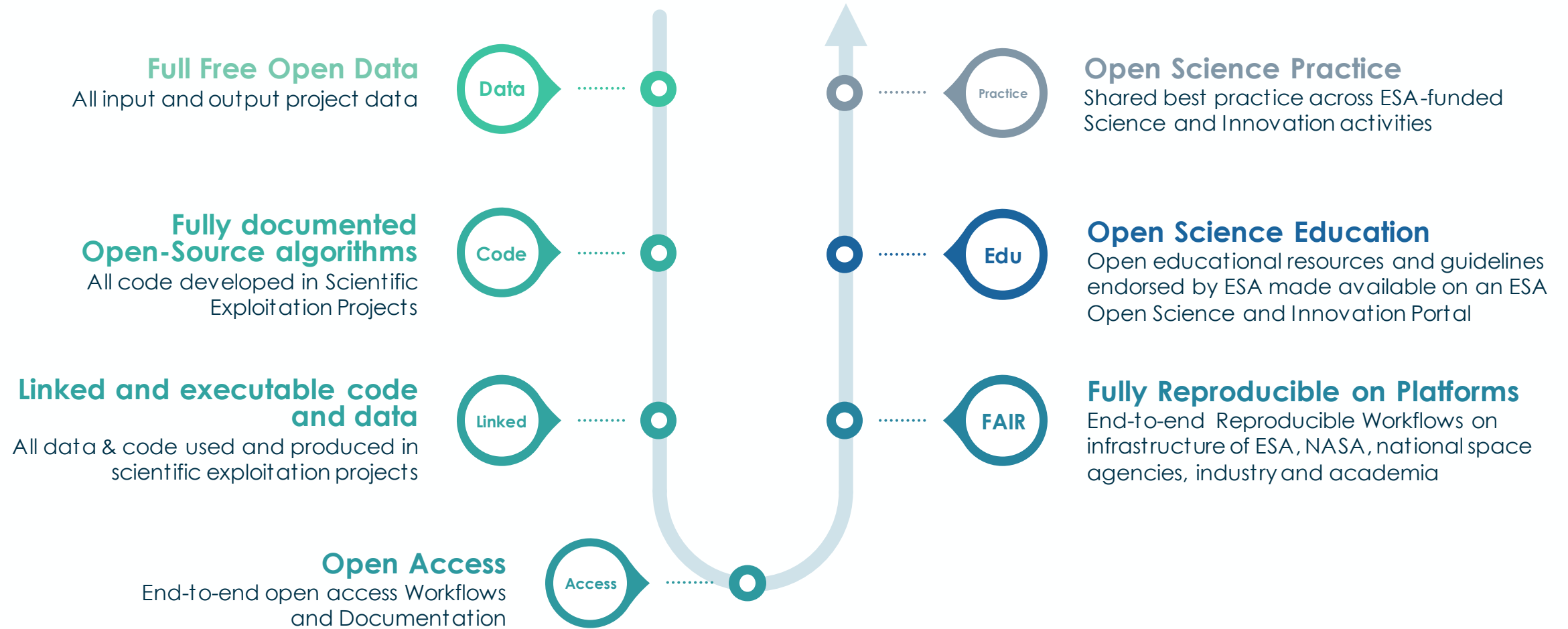
- **Advance Science**
  - Shared best-practices for science and R&D
  - Access to a wider pool of knowledge and resources
  - Sustainable research and development
- **Trusted and FAIR Science and Innovation**
  - More participation of underrepresented communities
  - Compensate for lacking resources and assets, reduce inequality
  - Trusted quality of research that is transparent and open for scrutiny
- **Reach the Wider Society**
  - Wider and more effective Communication and Collaboration
  - Spills-over in non-space domains
- **Foster Commercialization**
  - Access to complementary or lacking assets and capabilities
  - Shorter development cycles and lower costs



# EO Open Science and Innovation Vision



## Open Science and Innovation



# Visualization, Exploration, and Data Analysis

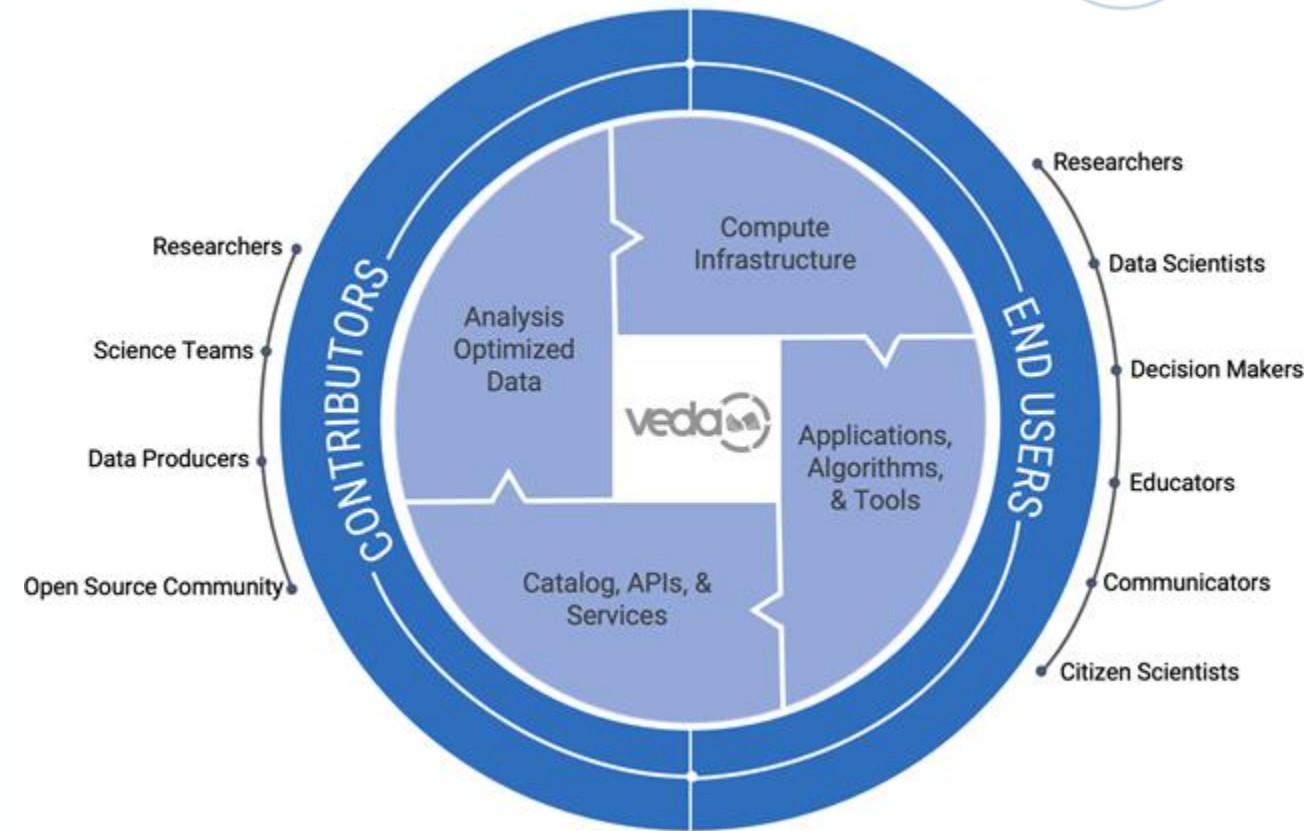


## Why?

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

## What?

VEDA is an open platform that brings key Earth science datasets next to **open source tools** for data processing, analysis, visualization, and exploration in a managed and **more accessible** computing environment



Explore

Analyze

Publish

Communicate

The image shows a screenshot of the NASA EarthData VEDA Dashboard. The top navigation bar includes 'Welcome', 'Discoveries', 'Datasets', 'Feedback', and 'About'. The current view is for the 'Nitrogen Dioxide' dataset, with sub-navigation for 'Overview', 'Exploration', and 'Usage'. The main interface features a date selector set to 'Jan 2016', a state comparison dropdown set to 'None', and a layers panel with 'No2' and 'No2 (Diff)' selected. The central visualization is a globe showing No2 concentrations over the United States. A legend at the bottom right of the globe indicates 'No2' with a color scale from 'Less' (blue) to 'More' (red). An inset window titled 'Datasets' is overlaid on the bottom left, displaying a grid of dataset thumbnails with titles such as 'Facebook Population Density', 'Harmonized Landsat Sentinel-2 (Selected Events)', 'Nighttime Lights supporting Environmental Justice', 'Blue tarp detections', 'Household and Disability Score', 'Housing Type and Transportation Score', 'Minority Status and Language Score', 'Overall Social Vulnerability', and 'Socioeconomic Indicators'.

Finding relevant data products

Exploring data to identify interesting features

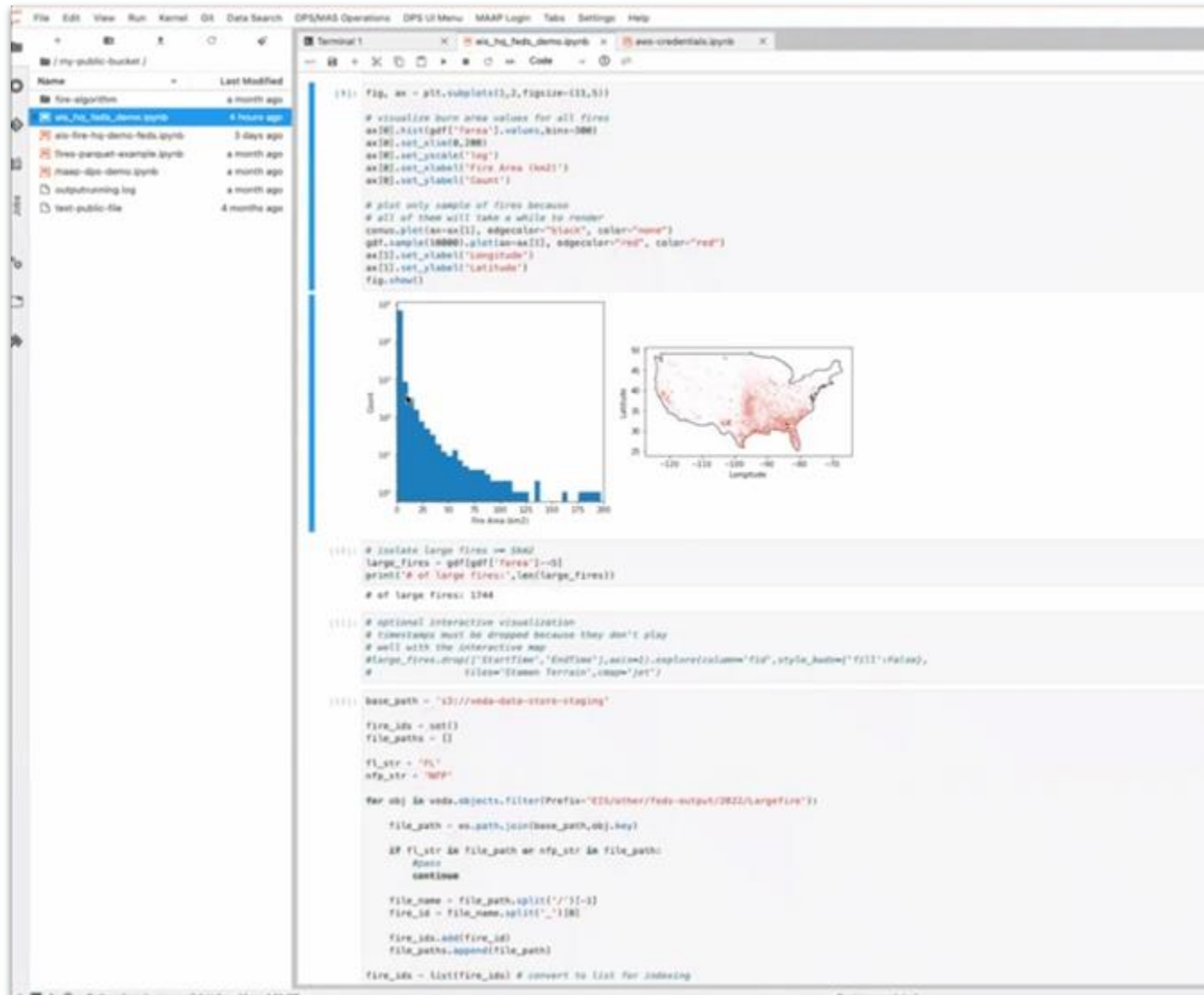


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Developing advanced data products and analysis

Carrying out calculations "in place" without the need to download data

Dynamically allocating resources for computationally demanding processing

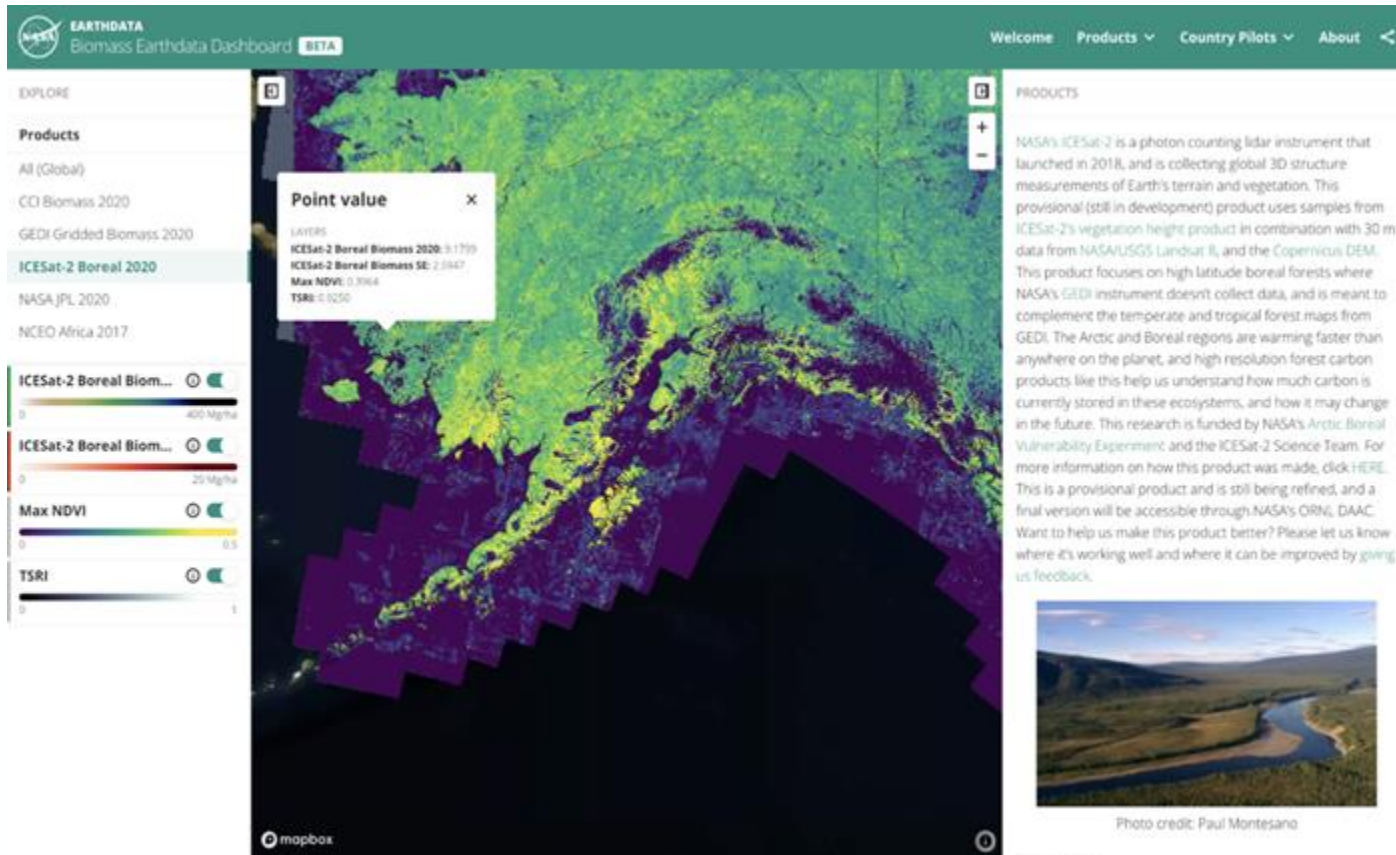


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Conveniently delivering data through existing interfaces

Providing automatic access to interactive visualization capabilities

Allowing users to analyze your products within the environment

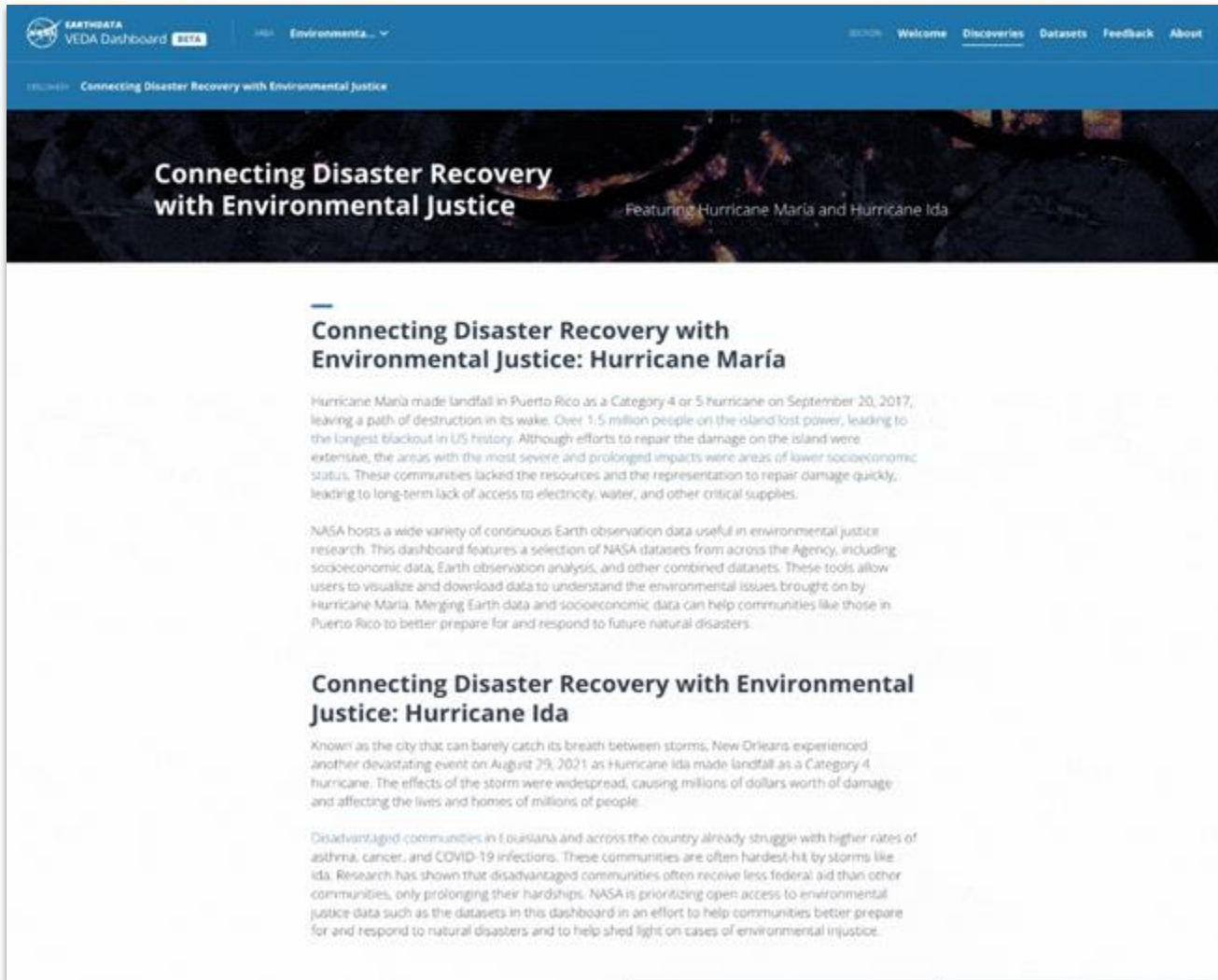


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The screenshot shows the NASA EarthData VEDA Dashboard interface. At the top, there is a navigation bar with the NASA logo, 'EARTHDATA VEDA Dashboard', and a 'BETA' badge. Below the navigation bar, there is a header section with the title 'Connecting Disaster Recovery with Environmental Justice' and a sub-header 'Featuring Hurricane María and Hurricane Ida'. The main content area contains two sections of text, each with a heading and a paragraph of descriptive text.

**Connecting Disaster Recovery with Environmental Justice: Hurricane María**

Hurricane María made landfall in Puerto Rico as a Category 4 or 5 hurricane on September 20, 2017, leaving a path of destruction in its wake. Over 1.5 million people on the island lost power, leading to the longest blackout in US history. Although efforts to repair the damage on the island were extensive, the areas with the most severe and prolonged impacts were areas of lower socioeconomic status. These communities lacked the resources and the representation to repair damage quickly, leading to long-term lack of access to electricity, water, and other critical supplies.

NASA hosts a wide variety of continuous Earth observation data useful in environmental justice research. This dashboard features a selection of NASA datasets from across the Agency, including socioeconomic data, Earth observation analysis, and other combined datasets. These tools allow users to visualize and download data to understand the environmental issues brought on by Hurricane María. Merging Earth data and socioeconomic data can help communities like those in Puerto Rico to better prepare for and respond to future natural disasters.

**Connecting Disaster Recovery with Environmental Justice: Hurricane Ida**

Known as the city that can barely catch its breath between storms, New Orleans experienced another devastating event on August 29, 2021 as Hurricane Ida made landfall as a Category 4 hurricane. The effects of the storm were widespread, causing millions of dollars worth of damage and affecting the lives and homes of millions of people.

Disadvantaged communities in Louisiana and across the country already struggle with higher rates of asthma, cancer, and COVID-19 infections. These communities are often hardest-hit by storms like Ida. Research has shown that disadvantaged communities often receive less federal aid than other communities, only prolonging their hardships. NASA is prioritizing open access to environmental justice data such as the datasets in this dashboard in an effort to help communities better prepare for and respond to natural disasters and to help shed light on cases of environmental injustice.

User friendly data-driven storytelling

Enrich science and applications narratives with interactive exploration

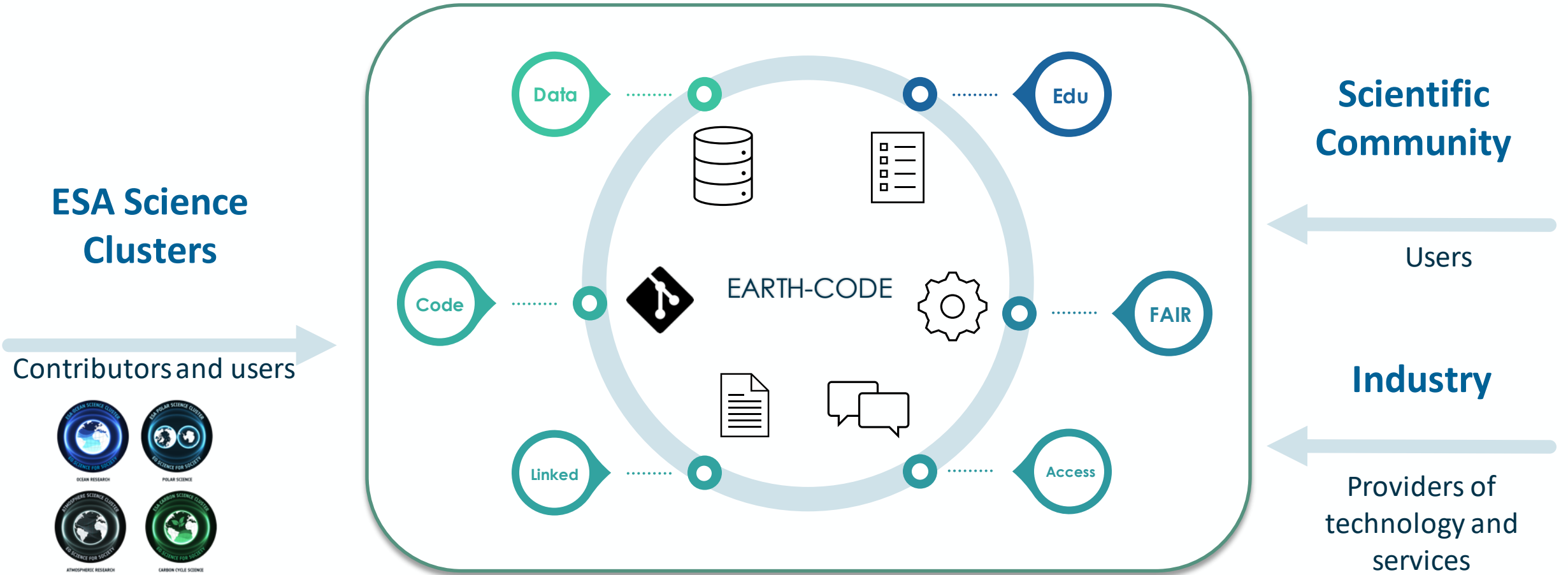




# EARTH-CODE

Earth Science Collaborative Open Development Environment

ITT to be published June 2023, 2M EUR





# Interoperability layer across infrastructures

## Concept:

Integrate a variety of heterogeneous data and processes  
Integration, training, provenance, and visualizations  
Compliment current initiatives while pioneering advance solutions

## Results:

Evolve spatial data, technologies, and related capabilities into valuable information for decision makers, science researchers, policy makers, data providers, and service providers to make informed decision and improve science and societal data usage and understanding.





Strategic joint ESA NASA, MS agencies initiative to drive digital innovation in Science

# Reproducible Open Science Persistent Demonstrator

- Beyond "FAIR" - **Reproducibility** and Reusability at core
- Demonstrates **Interoperability in Action** -> OGC standards and openEO API
- Hosted and coordinated by **OGC** relying on partners' **in-kind contributions** (open data or open infrastructure)
- "Outside-In model of Open Innovation" Exploring **innovative technologies**

## STATUS

- Agreement OGC-NASA-ESA formalised
- OGC Testbed-19 on datacube access tech. - KO 11 May  
<https://www.ogc.org/initiatives/t-19/>
- Specific use cases and pilot activities under definition

## NEXT STEPS

- Partnership with MS and industrial actors
- Pilot on Reproducibility Q4/23
- Pilot on Visualisation Q1/24



# Objectives

- Ensure a long-term framework - persistent Open Science Demonstrator where agencies / organizations contribute with data, tools, and infrastructures in a coordinated approach, building on existing investments
- Demonstrate end-to-end reproducibility on platforms for Earth Observation and Earth System Science workflows
- Create opportunities for cross-discipline scientific research in a neutral, web-based, permanently available Open Science framework
- Fully leverage on-premises and in-cloud capabilities, digital twins and newly accessible platforms through FAIR principles
- Create Analysis Ready Data (ARD) for diverse communities and accelerate standardization of ARD and Geo Data Cubes (GDC)
- Leverage visualization platforms for enhanced scientific communication and participation of research community, society and high-level users into the Open Metaverse.
- Define manageable Open Science processes and best practices for communities conducting geoscience research with heterogeneous data and tools on a distributed infrastructure
- Enable collaboration within and across communities and align on standards, vocabularies, and ontologies for data and workflows and develop community-wide Open-Source Science mechanisms.
- Compliment current initiatives, where possible include additional initiatives in this approach.



# (Tentative) Schedule

Project month	Description
June - August '23	Development of a Call for Participation (CFP) for the Open Science Demonstrator Design Experiment and public release
September '23	Proposals review, participants selection, and contracting
Sept- October '23	Kick-off meeting implementation phase
Sept. – Dec '23 (Mar '24)	Implementation phase Design Experiment
Dec '23 – Mar ' 24	Open Science Demonstrator prototype operational
Feb '24	Development of a Call for Participation (CFP) for the Open Science Environment and integration experiments and public release
Apr '24	Proposals review, participants selection, and contracting
May – Aug '24	Implementation phase Pilot-1
Sept '24	Delivery of results