EO Platforms and Services for Earth Action – enabling sustainable science and applications in a cloud-based federated ecosystem

CCI colocation meeting, 25 March 2026

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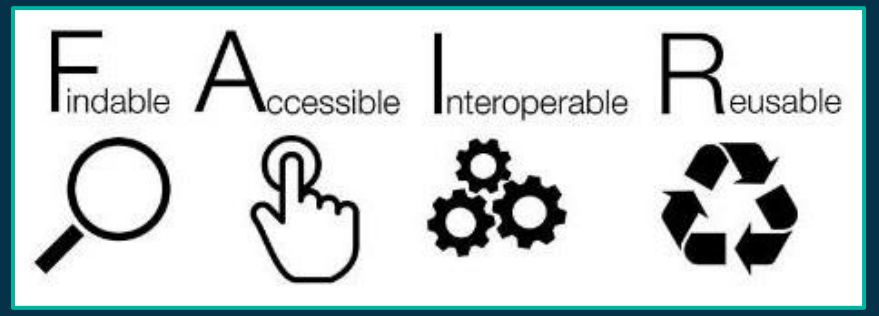
Earth Action & Digital Innovation

- **Earth Action** is grouping several program elements under a single pillar: EO4Society & Phi-lab, Climate Space, Global Development Assistance

- Transversal elements in Earth Action include **Digital Enablement & Disruptive Innovation**



- ESA EO **Digital Innovation Strategy** transforms Science into Societal Benefits via cloud-based Collaboration, Sharing and Production Environments

- This needs to be enabled by a **FAIR compliant ecosystem** of EO platforms and other digital resources

Earth Action: turning Science into Services for Society

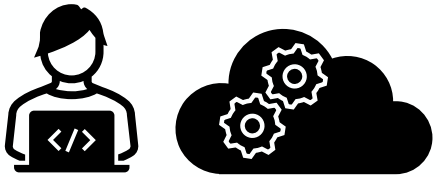
EarthCODE – Build FAIR Science

Guides and supports scientists to develop FAIR scientific products and algorithms.

- Enables reproducible, FAIR EO workflows and data products
- Provides data & workflow engineering on cloud platforms
- Establishes a long-term, accessible knowledge base

APEx – Operationalise & Scale

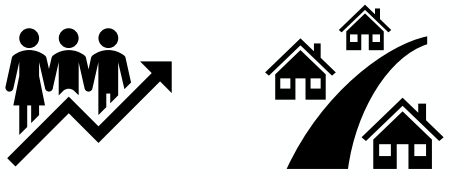
Builds on FAIR compliance to propagate EO Applications and cloud-based services.



- Ensures FAIR compliance of EO applications and services
- Promotes interoperability across platforms & communities
- Turns R&D algorithms into cloud-based on-demand services

Information Factories – Deliver Value

Builds on cloud-based services to deliver actionable insights useable by stakeholders.



- Converts EO services into actionable insights
- Integrates outputs into decision-making workflows
- Enables uptake in commercial and policy markets

Knowledge Development
TRL 1 – 3: Basic research – research to prove feasibility

Technology Development
TRL 4 – 6: Tech. demonstration – prototype developmer

Business Development
TRL 7 – 9: Pilot & scale up – Market launch & commercialisation

What is EarthCODE ?

A strategic ESA initiative to provide scientists with skills, means and tools to adopt FAIR Open Science

FAIR = **F**indable, **A**ccessible, **I**nteroperable, **R**eusable

Who are the users?

ESA-Funded Research and ESA collaborative initiatives (e.g., ESA-RTD Earth System Science Initiative)

Who implements EarthCODE?

An ecosystem of platforms and service providers that implement the same interoperability standards

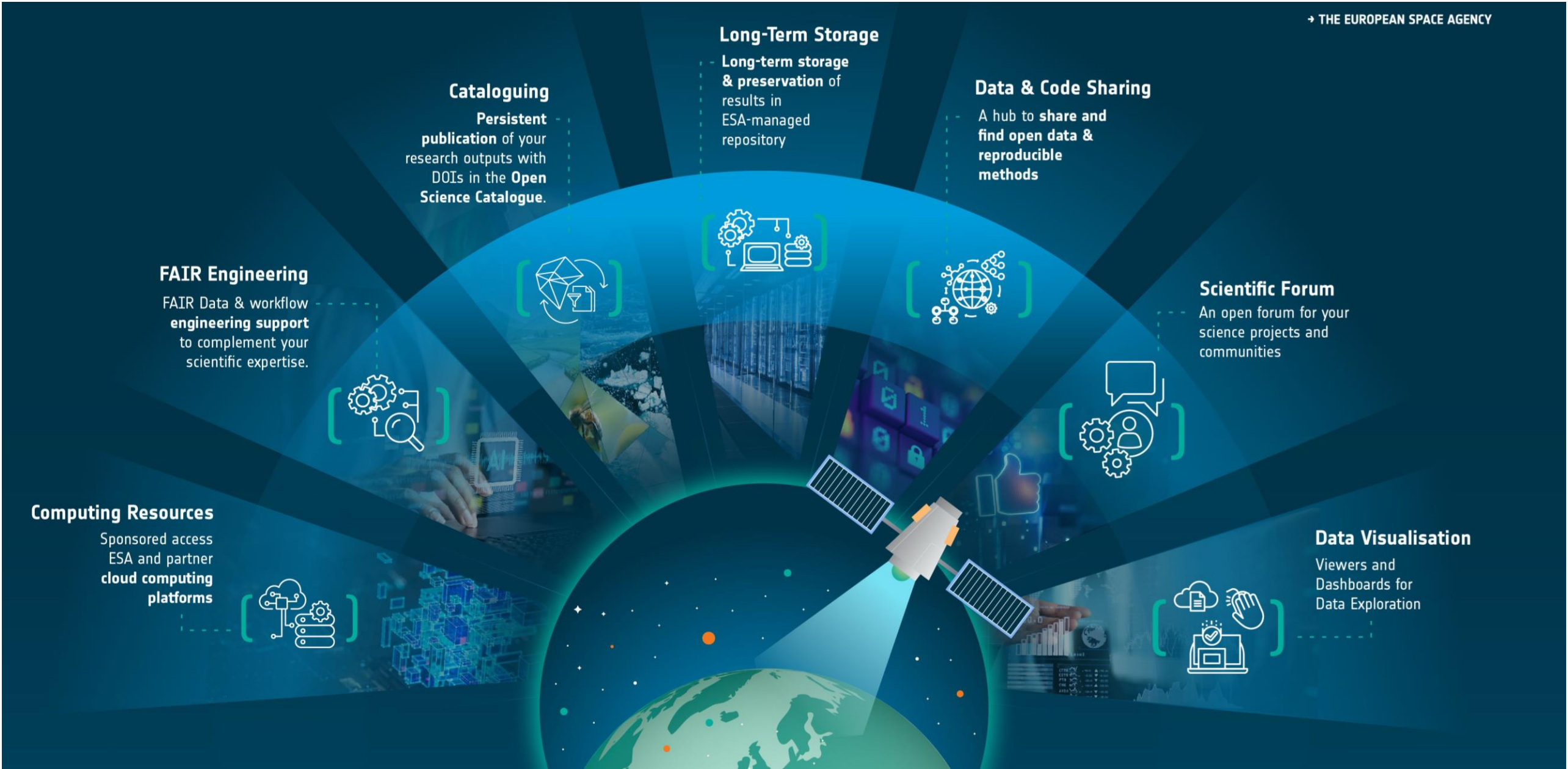
Providers selected in open competition, via yearly Best Practice Procurements

+NOR Providers

+National Infrastructures

+Other partners

What does EarthCODE offer ?



EarthCODE Services to support Science Projects

Develop new scientific algorithms → Generate new Products → Catalogue & Publish code & data → Store FAIR code & data persistently → Visualise & Disseminate → Collaborate

Run workflows on platforms

Seamless access to an expanding ecosystem of cloud-based Earth Observation platforms. No setup needed.

Data & workflow engineering support

Get support to transform the data into cloud-optimized formats, and FAIR-ify data and workflows.

Publishing scientific experiments

Upload data, workflows, and results. Make them reproducible and citable.

Discover & Reuse

Search and filter through published science assets. Use in local or cloud environment.

Visualisation of the results

Built-in tools and dashboards to plot, compare, and share geospatial outputs.

Community Forum

Join discussions, ask questions, and exchange best practice.

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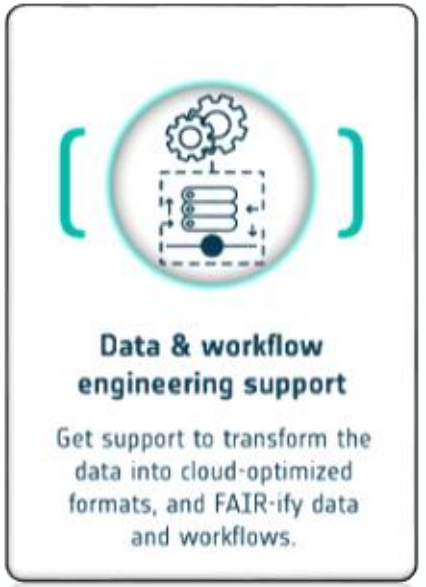
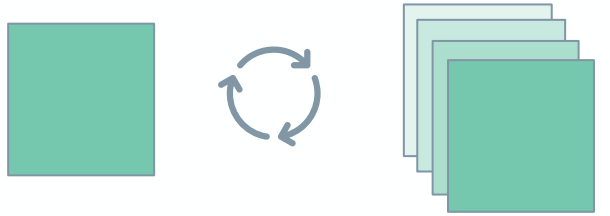


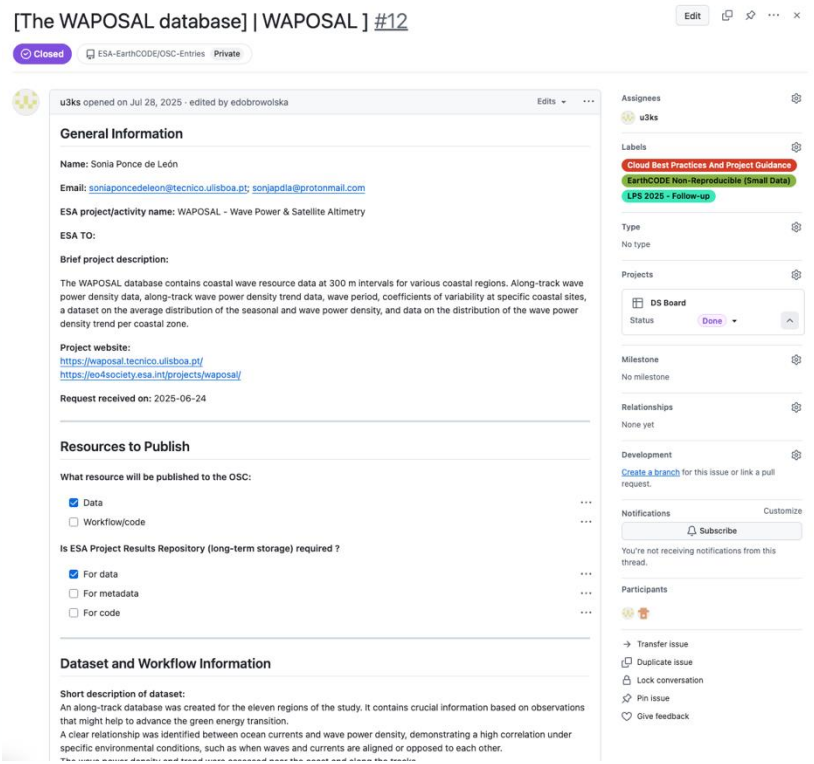
2 flavours

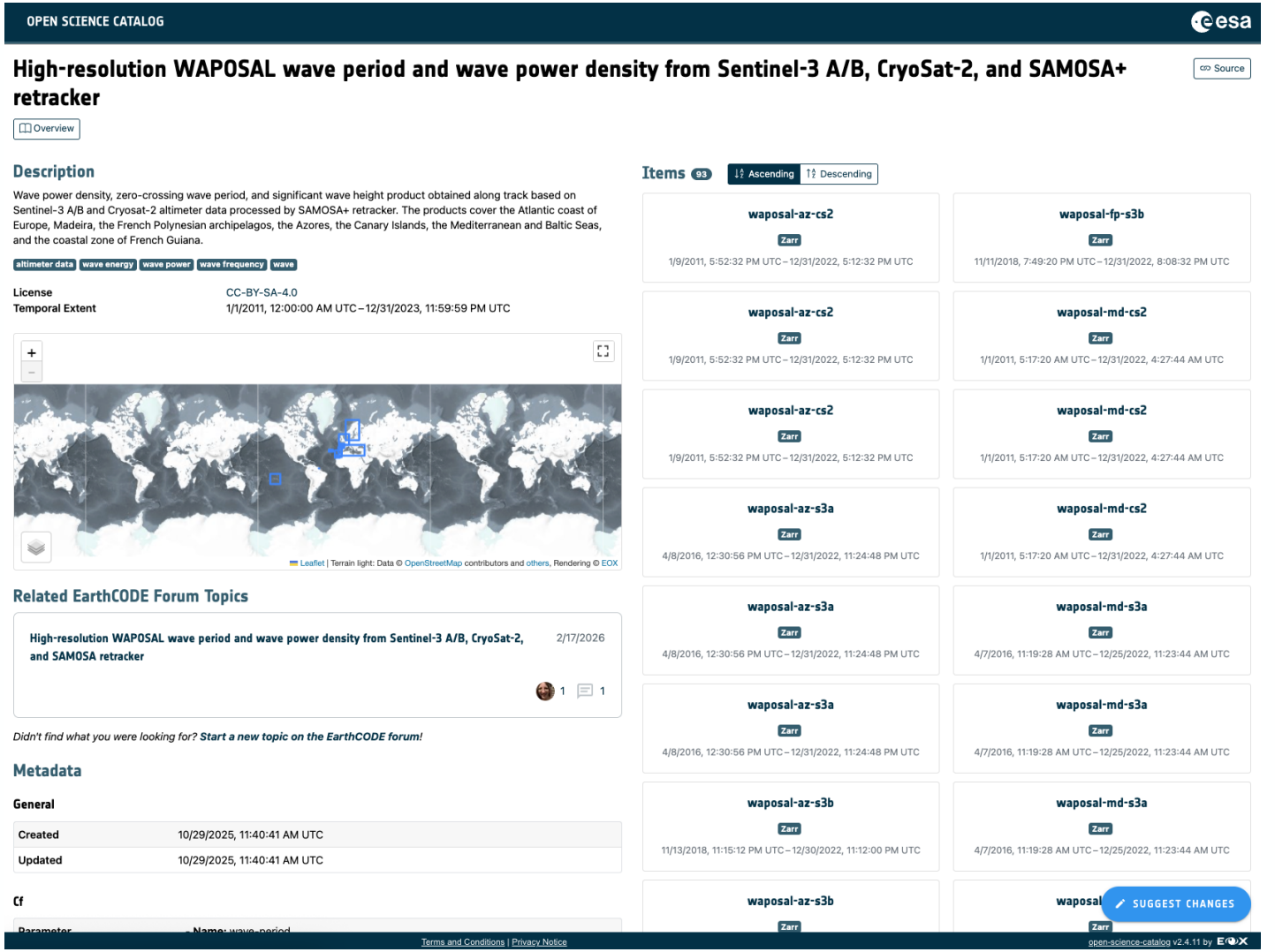
1. FAIR Engineering Service – Specialised Data & Worksflow Engineering support to complement your project's science team

2. Scientific Data Update Service – continuously update scientific data products using automated, mature workflows



FAIR Data Products in the Open Science Catalogue





EarthCODE Open Science Catalogue entry

ESA Polar Science Cluster Antarctic Data Collection

https://s3.waw4-1.cloudferro.com/EarthCODE/OSCAssets/antarctica_cube/antarctica-combined.zarr

- Bedrock topography
- Ice shelf Basal Melt
- Groundlines
- Subglacial Lakes
- Supraglacial Lakes

•https://s3.waw4-1.cloudferro.com/EarthCODE/OSCAssets/antarctica_cube/icetemp.zarr

- Ice Temperature Profiles

•https://s3.waw4-1.cloudferro.com/EarthCODE/OSCAssets/antarctica_cube/sec.zarr

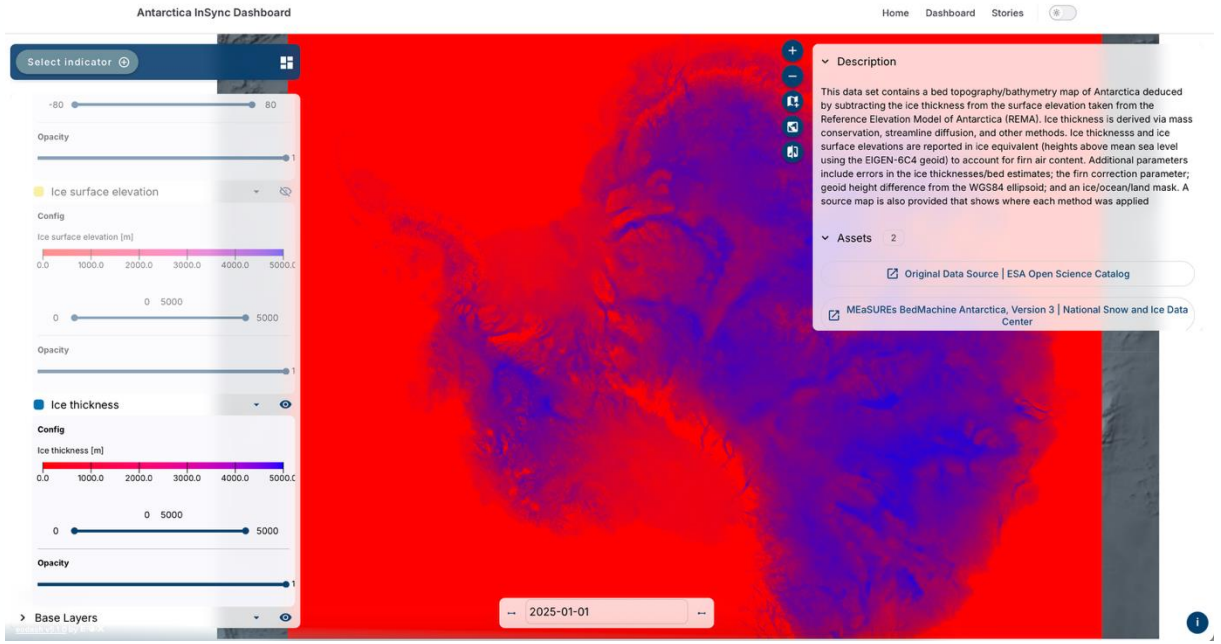
- Surface Elevation Change

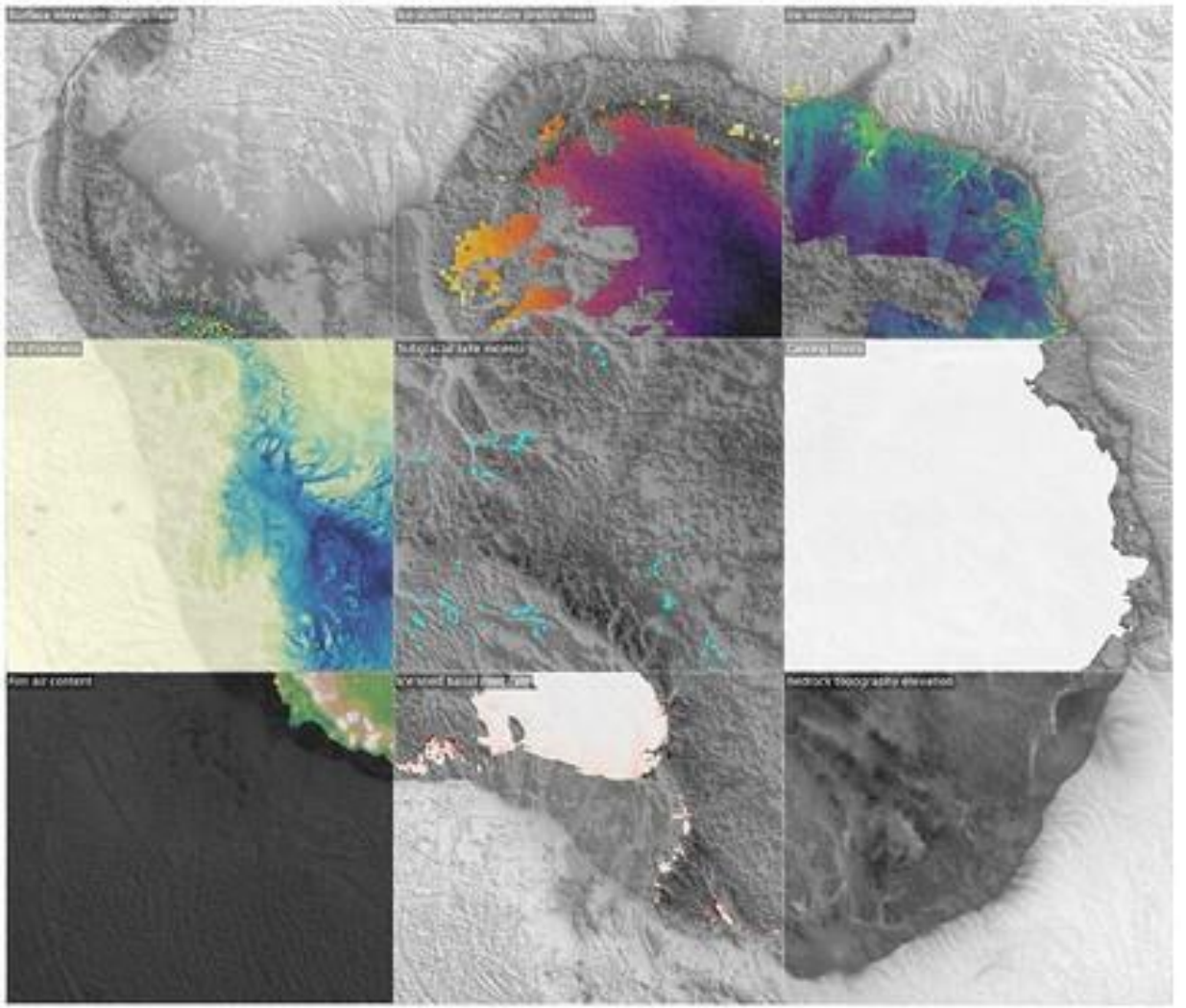
•https://s3.waw4-1.cloudferro.com/EarthCODE/OSCAssets/antarctica_cube/icemask_composite.zarr/

- Calving Fronts

•https://s3.waw4-1.cloudferro.com/EarthCODE/OSCAssets/antarctica_cube/ice_velocity.zarr

- Ice Velocity 2020-2021





What is APEx?

Application Propagation Environments (APEx)

An EOP strategic initiative to promote FAIR compliance for EO applications and cloud-based services.

Who are the users?

APEx supports ESA projects, the larger EO community and EO value-adding industry.

Who implements APEx?

The main APEx services and solutions are developed by a core consortium.

APEx seeks to support an open federation of EO platforms, value-adders and (operational) users.

Consortium:

vito · Brockmann Consult · inuits · geo · Terradue · development SEED · thriveGEO

Federated platforms:

CDSE Copernicus Data Space Ecosystem · openEO · eodc · TAC · openEO Platform · geohazards tep by Terradue · Tiler

EO value-adders:

CS a Sopra Steria company · Brockmann Consult · gisat · Terradue · EarthDaily analytics · SINERGISE · COMPASS Information and Location · eodc · gmv · development SEED · UCL University College London · DHI · EOX · DLR · eurac research · vito Remote Sensing

https://apex.esa.int/

What does APEx offer?

ALGORITHM SERVICES

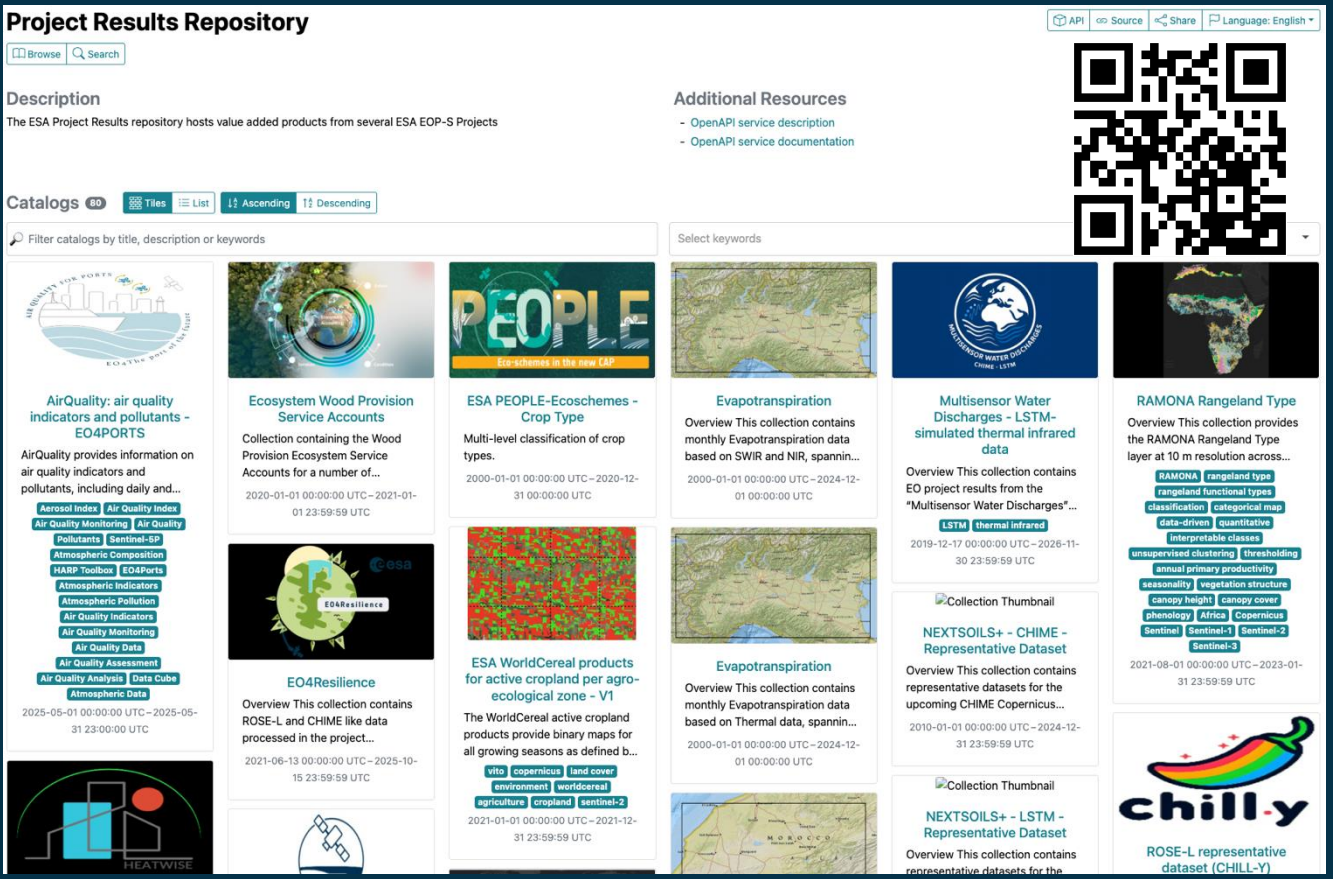
APEx provides custom support to preserve, enhance, and transform project outcomes into scalable, reusable services, ensuring they remain impactful and drive a future innovation.

PROJECT TOOLS

APEx provides project cloud based project development environment, consisting of various components that are deployed in the cloud on demand and that are tailored in look and feel to match the project context.

ESA Project Result Repository (PRR)

- ✓ Open data repository on ESA Cloud ensuring long-term accessibility of higher-level, value-added products
- ✓ EOP-S curated and operated, serving Earth Action vision, driven by APEx and EarthCODE
- ✓ Products accessible publicly via STAC catalogue
- ✓ Requirement for *cloud-native* data formats and specifications: https://eoresults.esa.int/prr_faq.html

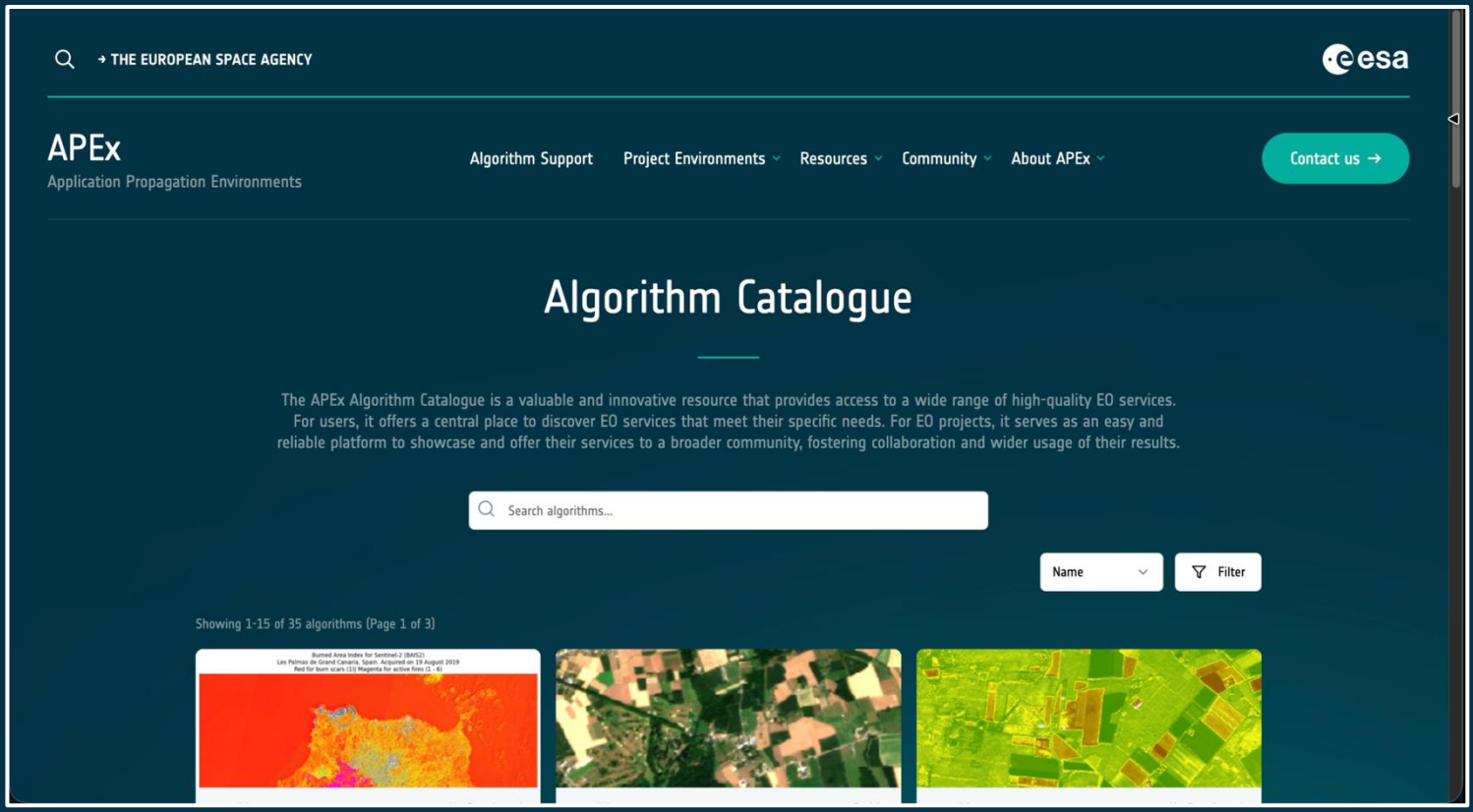


Relevance for Earth Action:

- + "Streaming access" to EOP-S value-added products
- + Centralised long-term preservation of project results

APEx Algorithm Catalogue

- ✓ Curated collection of executable and FAIR compliant on-demand algorithms deployed on federated EO platforms
- ✓ Algorithms implemented as openEO User Defined Process (UDP) or EO Application Packages (EOAP)
- ✓ Routine benchmark tests to monitor algorithm availability & functioning

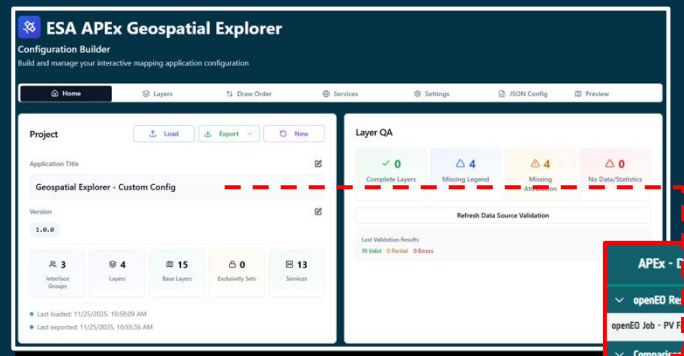


https://algorithm-catalogue.apex.esa.int/

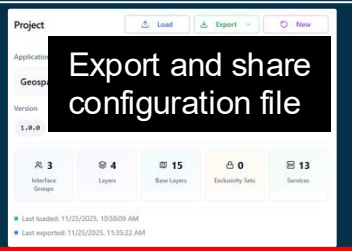
Relevance for Earth Action:

- \+ Discover and reuse value-adding solutions
- \+ Promote adoption & uptake of algorithms
- \+ Compatibility with APEx productivity tools e.g. for upscaling or systematic processing

APEx Geospatial Explorer – build your own showcase

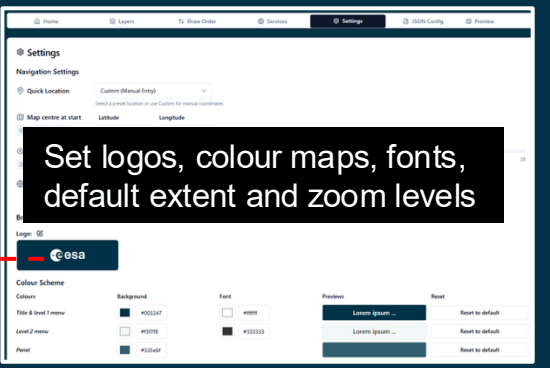


Define interface groups and map layers along with attribution and layer styling

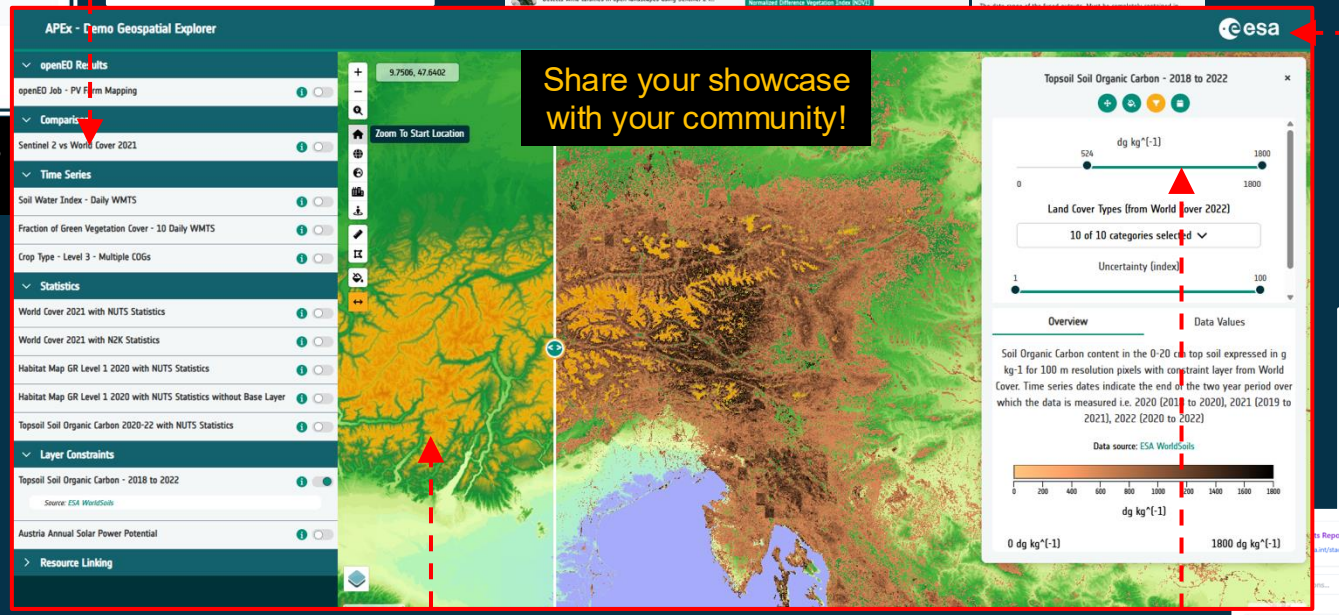


Export and share configuration file

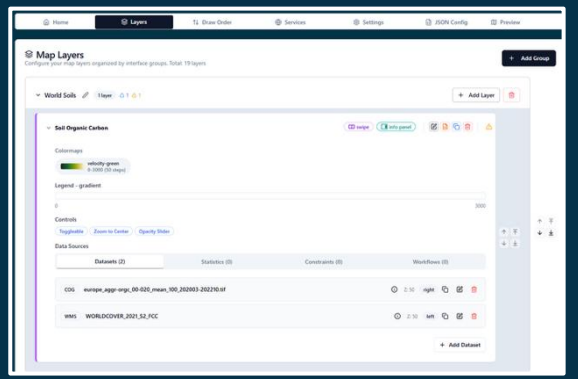
Set-up interactive execution of on-demand algorithms

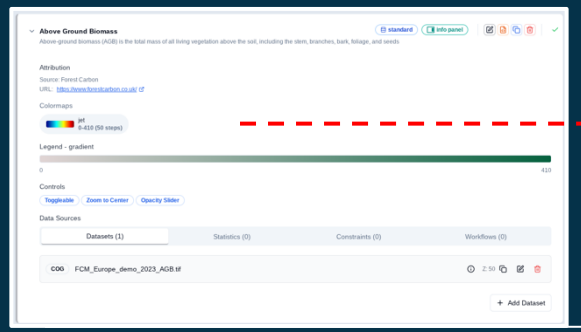


Set logos, colour maps, fonts, default extent and zoom levels

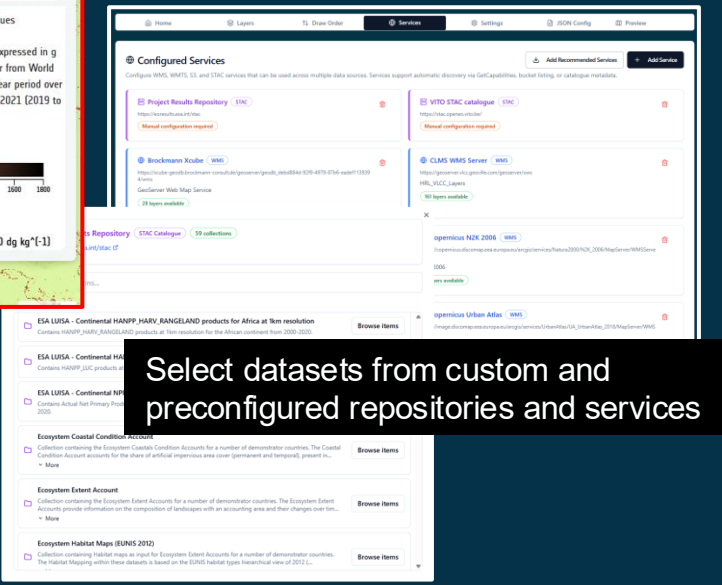


Share your showcase with your community!





Configure interactive tools



Select datasets from custom and preconfigured repositories and services

https://apex-ge-config-builder.sparkgeo.uk/

Information Factory Vision

The ”Last Km" Challenge

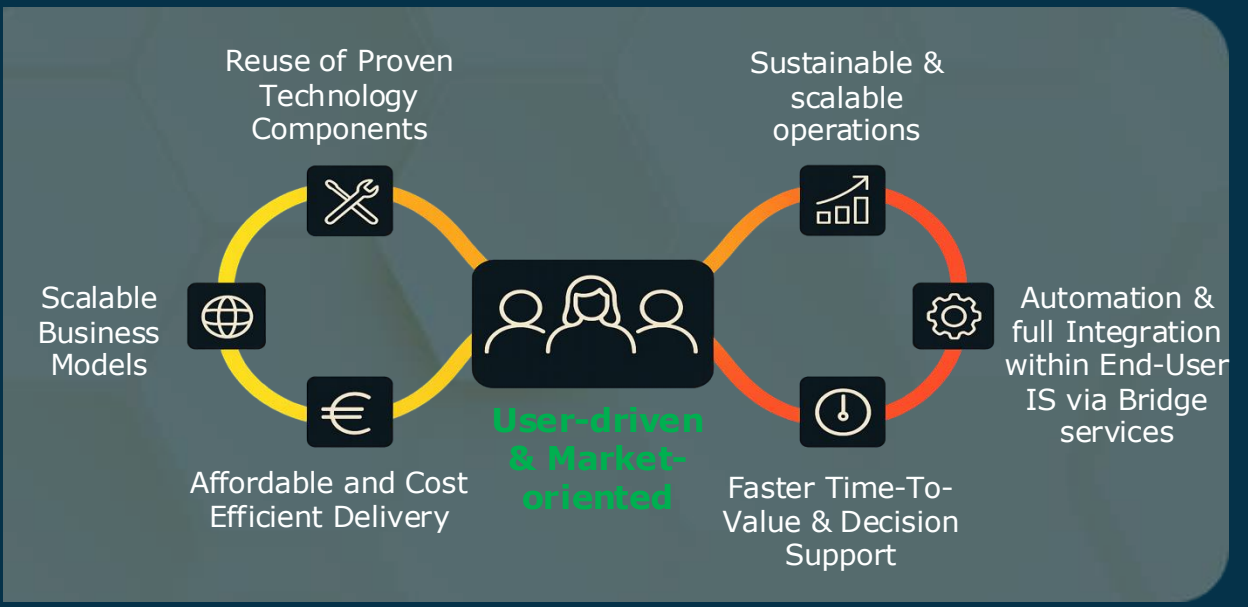
- **Technical**: fragmentation in the EO value-adding community, linking EO and non-EO products, integrating solutions within end-user workflows, processes and IS
- **Business & operations**: fitness-for-purpose, scaling mechanisms, business & partnership models, governance etc

Who are the users of an IF?

The IF brings together several actors from the service production and consumption value chain including:

What is an Information Factory (IF)?

A commercially operated ecosystem of scalable and cost-efficient cloud capabilities, services, technical & business tools, facilitating the customization and integration of EO solutions addressing stakeholder needs and supporting their decision-making and operational processes



Information Factory ongoing activities: *IF Pathfinders for Adaptation*

IF Urban

- Technical implementation based on TAO platform and xcube services
- Geographic focus: Germany
- Anchor stakeholders include Firefighters Düsseldorf, LGV Hamburg and City of Berlin
- Urban resilience domain

Climate Resilience & Emergency Response for Real- Time Urban Situational Awareness Platform

Climate-Smart Cities & Infrastructure

Climate Risk Insights & Mitigation

Climate-resilient food systems

Ubiverde IF

- Technical implementation based on EOEPCA components
- Geographic focus: France
- Anchor stakeholders include Cities of Perpignan, Nancy, La Roche-sur-Yon and Kourou
- Urban resilience domain:

Service tiers 1 – Observation and key urban Indicators (e.g. Vegetation mapping, Air Quality etc)

Service tiers 2 – Ecosystem services

Service tiers 3 – Climate impact and projections

Information Factory ongoing activities: *IF Pathfinders for Adaptation*

Climate Smart Agriculture IF

- Technical implementation based on Creodias
- Geographic focus: initial focus on Europe (Germany), potential global applicability
- Anchor stakeholders include MyEasyFarm, CrowdFarming, Opterra and Allianz Agrar AG
- Adaptive agriculture domain:

Climate Resilient Farming

Carbon Farming

Hazard assessment and monitoring

Climate Adaptive Seed Production

ADAPTA-IF

- Technical implementation based on EOEPCA components
- Geographic focus: Africa, Asia, Europe
- Anchor stakeholders include CABI and CottonConnect
- Adaptive Agriculture Domain:

Production Risk for the Cotton Supply Chain

Maize Yield Optimization in Kenya

Better Decisions for Olive Farms in Cyprus

Dutch IF

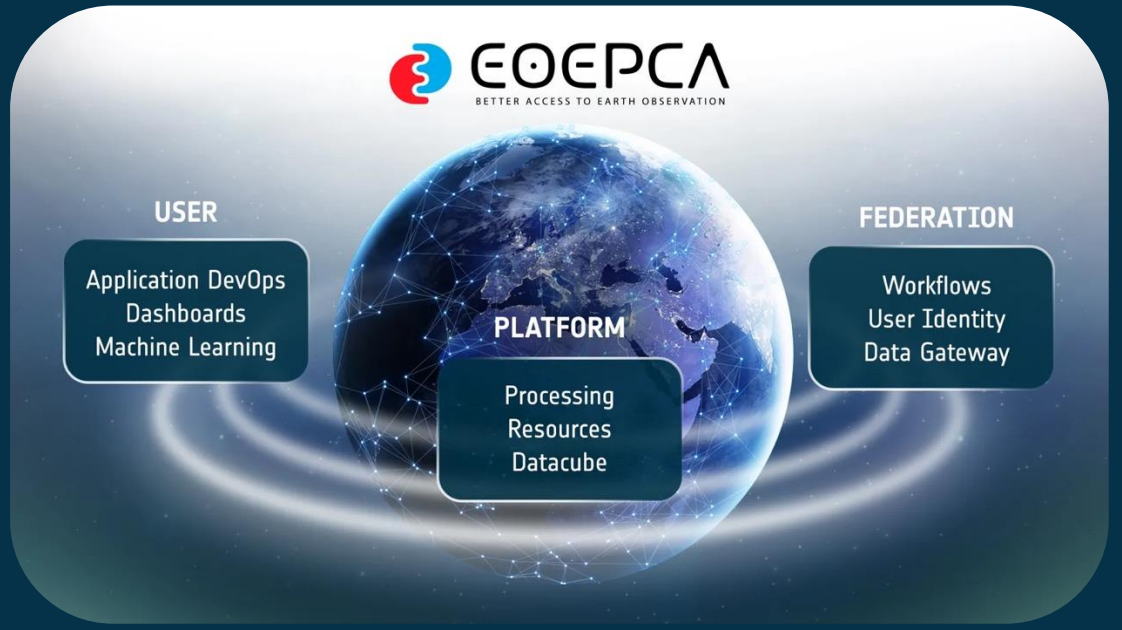
- Technical implementation based on Ellipsis Drive Proprietary Platform
- Geographic focus: NL & BE
- Anchor stakeholders include the city of Almere (NL), Rabobank and Province of Drenthe
- Urban resilience / adaptive agriculture:

Financing Climate-Resilient Agriculture in Dutch Provinces

Monitoring Agricultural buffer strips for Water Quality and Biodiversity

Supporting Cities in Sustainable Energy and Climate Action Planning

Digital Innovation - Transversal elements



EOEPCA+ (EO Exploitation Platform Common Architecture):

- Reusable (software) building blocks ensuring interoperability between EO platforms
- Large open-source community participation and uptake
- www.eoepca.org

NOR (Network of Resources):

- Portfolio of European EO platform services
- Sponsorship mechanism to support uptake and derisking
- EarthCODE & APEx services are offered via NoR
- https://nor-discover.org

Conclusion: Digital Innovation & Earth Action

- The presented initiatives support EO projects and scientists at different stages on the EO value chain
- A key objective of the Digital Innovation strategy is to enable an **ecosystem of FAIR compliant solutions** in support of Earth Action
- Today was just a brief introduction - a **dedicated webinar** for the CCI/Climate Space community will be organised to introduce the initiatives and related engagement opportunities in more detail