

Streamlining operationalisation of EO-based solutions for the Green Transition using interoperability best-practices.



GEO-OPEN-HACK-2024
26 June 2024, IIASA

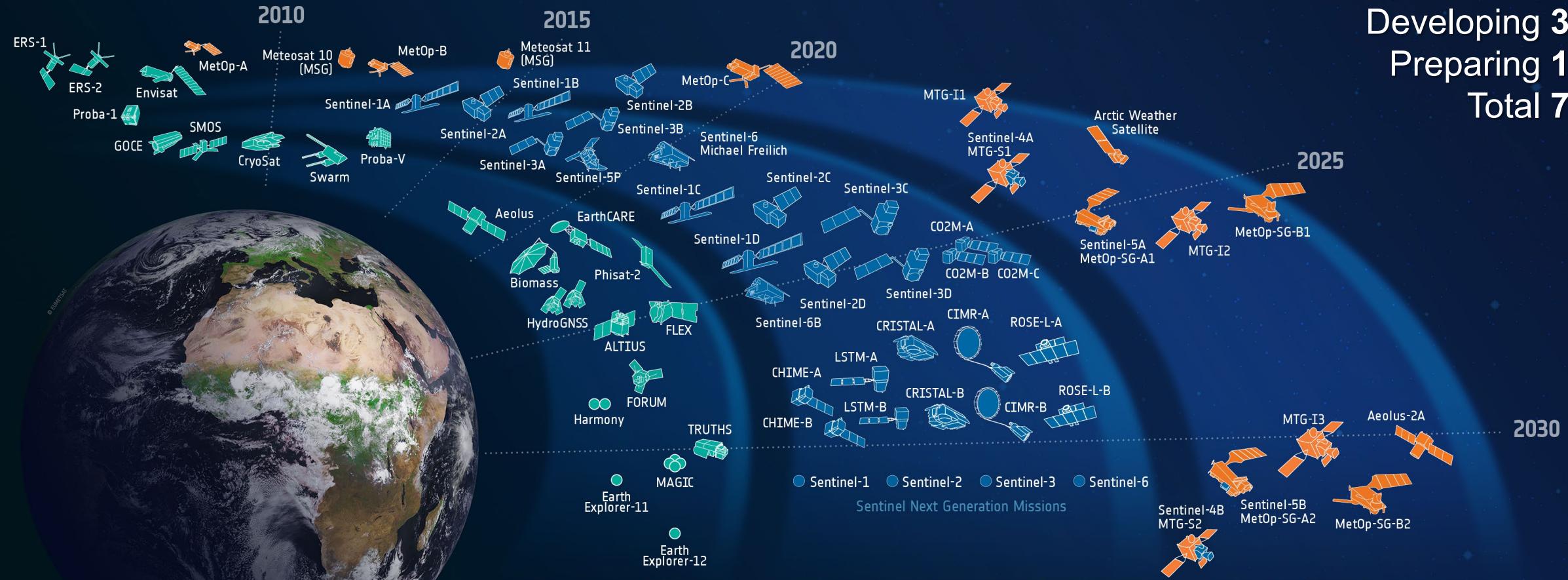
Patrick Griffiths,

European Space Agency – EO Programmes
Climate Action, Sustainability & Science Department

ESA's Earth Observation Missions

The golden era of remote sensing

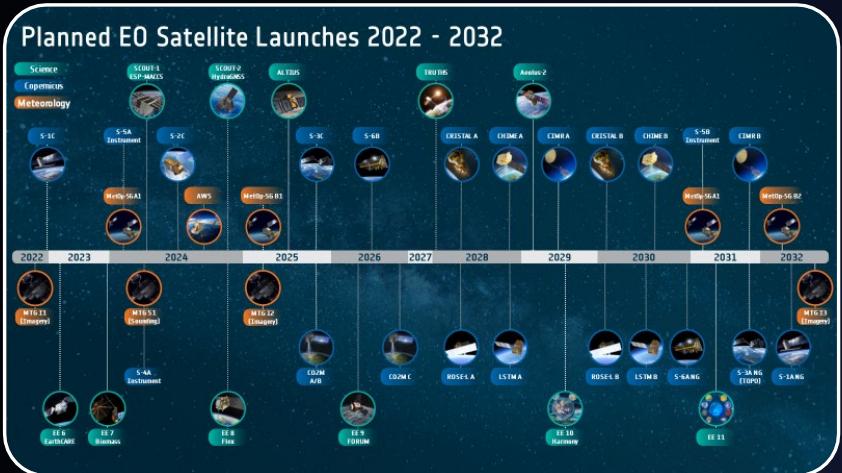
Satellites
 Heritage 08
 Operational 12
 Developing 39
 Preparing 18
 Total 77



Earth Observation Activities at ESA



Building satellites



Managing Missions



Cal/Val & Data Distribution



Earth System Science



Applying the Data



Innovation



& Commercialisation



EO Supports Major International and European Policy Frameworks



UN SDG for 2030



Paris Agreement on
Climate Change

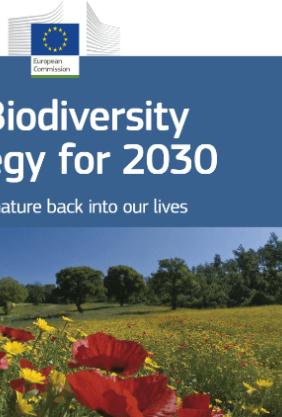
The Sendai Framework for
Disaster Risk Reduction 2030



NEW CAP
#NewCAP
New Common Agricultural Policy



New EU Forest Strategy for 2030



EU Biodiversity
Strategy for 2030

Bringing nature back into our lives



THE EU'S ARCTIC POLICY
A SAFE, STABLE, SUSTAINABLE, PEACEFUL
AND PROSPEROUS ARCTIC

Land Degradation Neutrality

Green Transition Information Factories (GTIF)



ENABLE INSIGHTS: Demonstrate added value of EO and digital technologies for addressing the information needs of the Green Transition and the European Green Deal.

ACTIONABLE INFORMATION: enable users (e.g., citizens, policy makers, industry professionals) better understand related challenges and opportunities & join the public debate.

DEDICATED CAPABILITIES: value-added products, indicators & interactive tools, reproducible workflows.

Initial focus on set of 5 Green Transition **PRIORITY DOMAINS**:



ENERGY
TRANSITION



MOBILITY
TRANSITION



SUSTAINABLE
CITIES



CARBON
ACCOUNTING

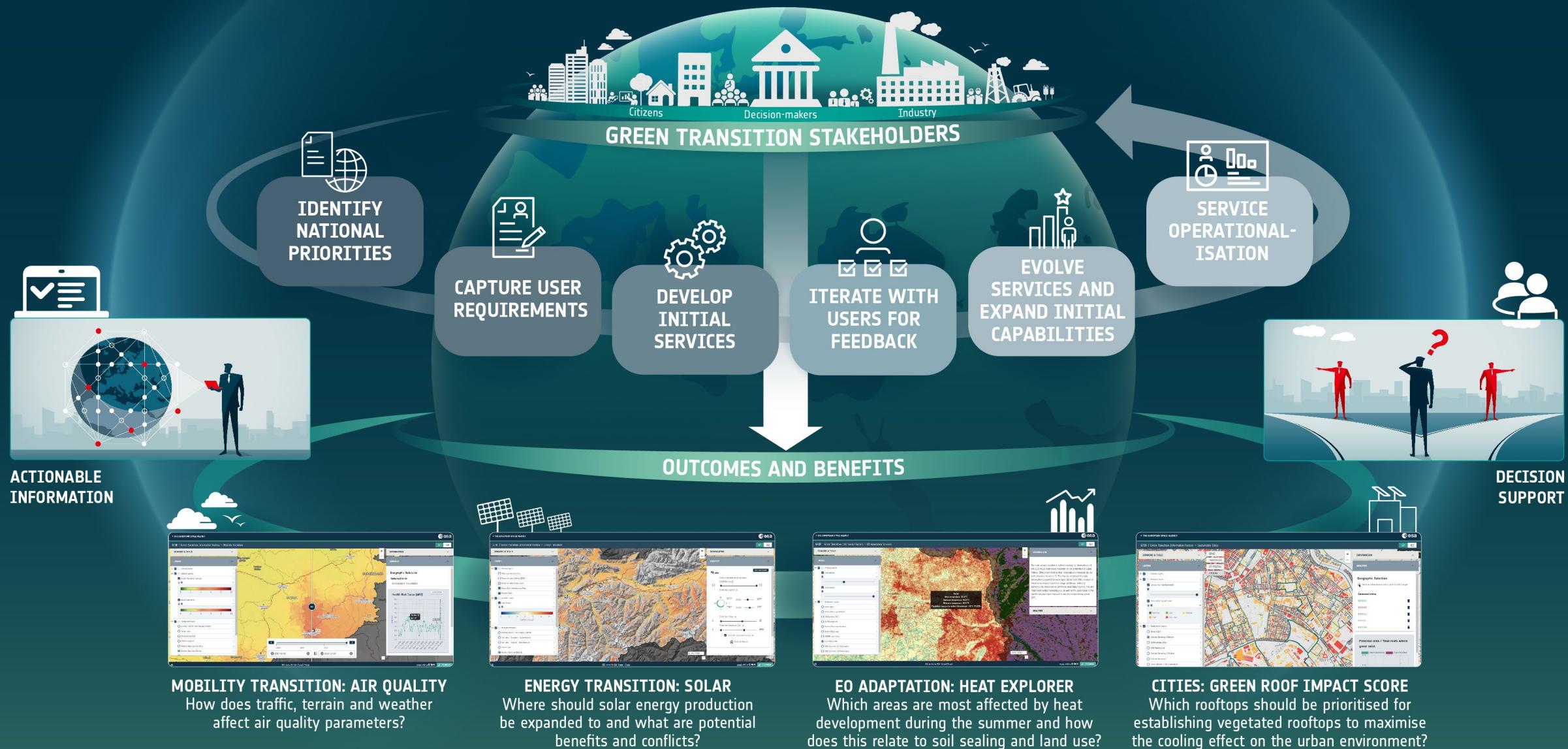


EO ADAPTION
SERVICES

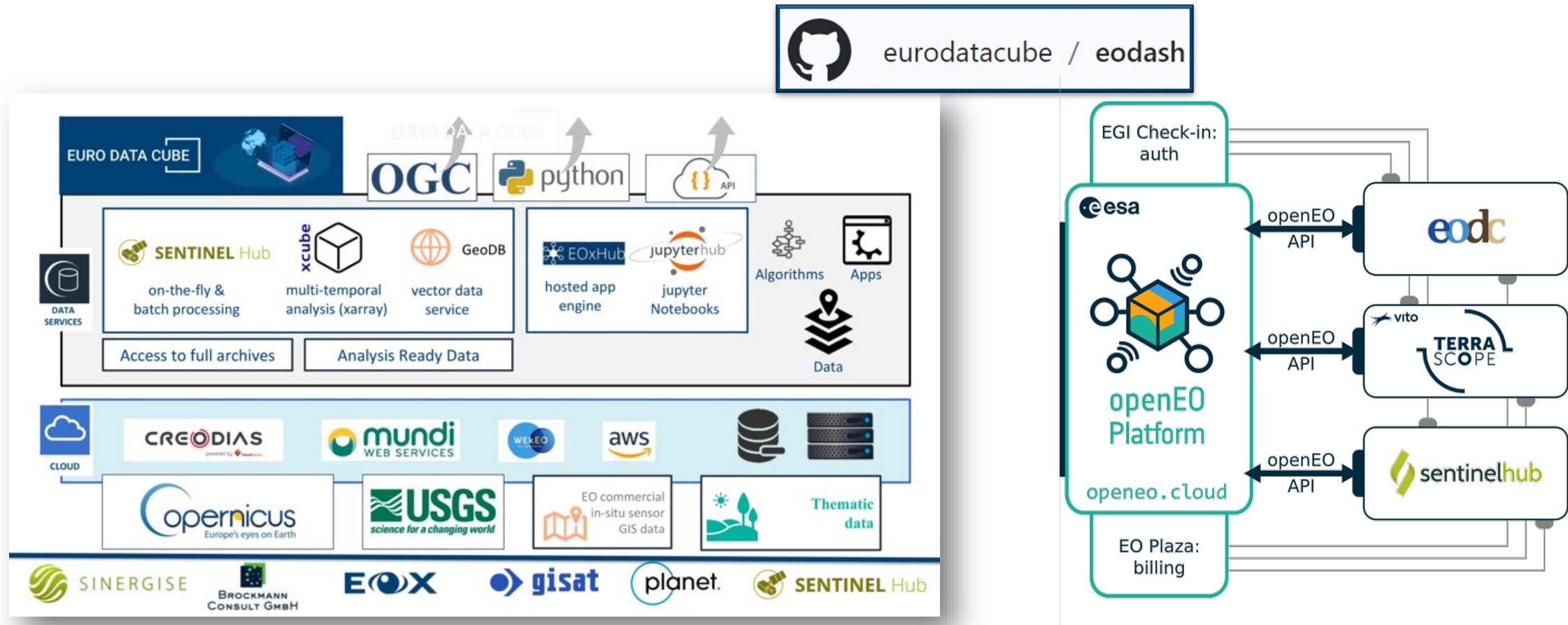
Streamlining Stakeholder Engagement Approach

GREEN TRANSITION INFORMATION FACTORIES (GTIF)

GTIF CO-CREATION PROCESS



GTIF - Powered by the Cloud(s)





Green Transition Information Factory

Demonstrator for Austria

<https://gtif.esa.int/>



GTIF

Green Transition Information Factory

FEEDBACK

GTIF “Kick-Starter” projects

- **GTIF Kick-Starters ITT:**
 - Next phase of GTIF activities, three separate contracts
 - Kicked-off Q1 2024
- **Goals & objectives:**
 - Develop novel innovative capabilities to address stakeholder needs within 5 GT domains
 - Within 6 months, demonstrate capabilities within a new **national showcase**
 - Enhance capabilities in terms of robustness and scalability
 - Demonstrate in a **multi-national/regional showcase**
 - Transform capabilities into replicable, FAIR compliant, on-demand services



1) GTIF Baltic

- Phase1: Lithuania, Phase2: Germany, Poland, Estonia, Latvia
- OHB (DE), EOX (AT), COETUS (LT), GEOMATRIX (LT)

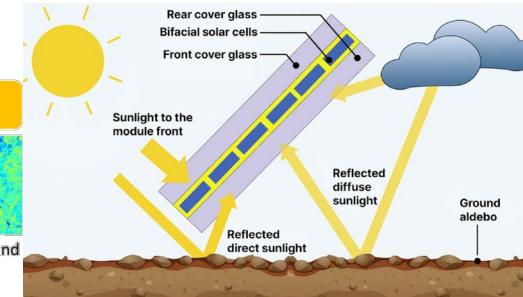
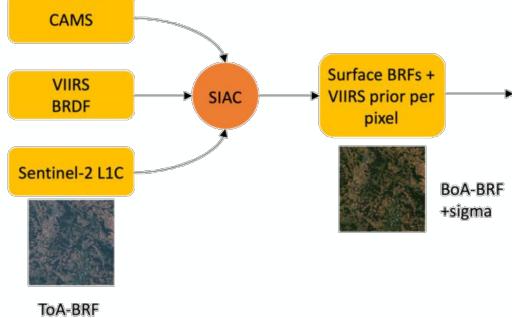
2) GTIF UKIF

- Phase1: UK & Ireland, Phase2: France
- UCLc (UK), SAIL (UK), Compass Informatics (IE), Earth Daily Analytics (CA)

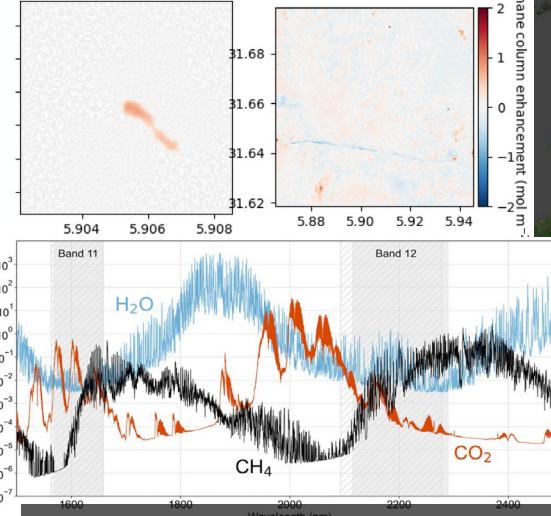
3) Cerulean GTIF

- Phase1/Phase2: N Atlantic coastal waters (Europe, Canada, Greenland)
- Polar View (DK), EOX IT (AT), NRC (CA), DMI (DK), C-CORE (CA)

Solar farming (bifacial, mixed use)



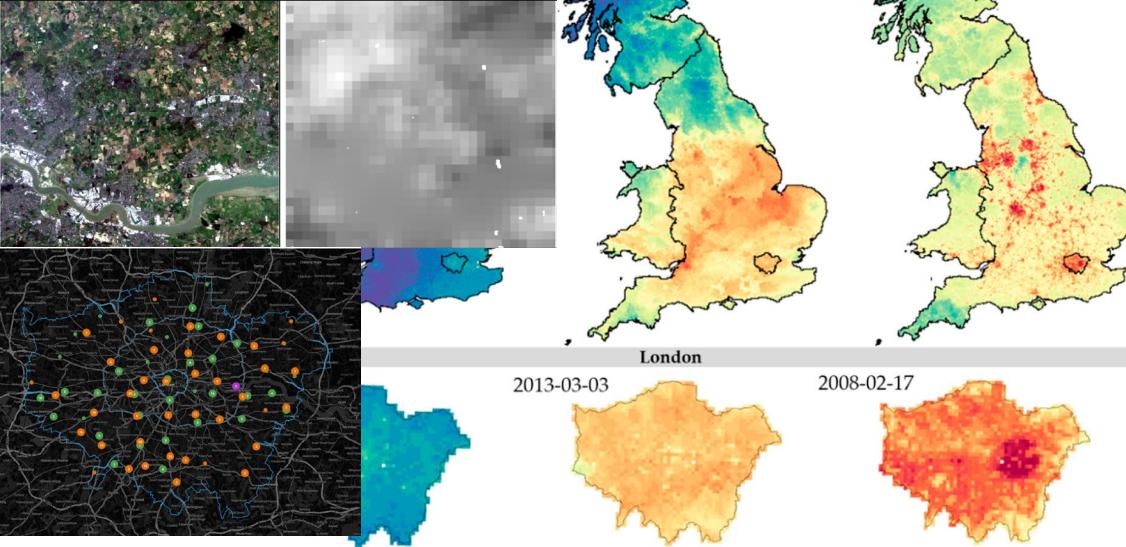
Methane plume detection



Drought monitoring



Street level PM2.5



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Thermal Anomaly mapping

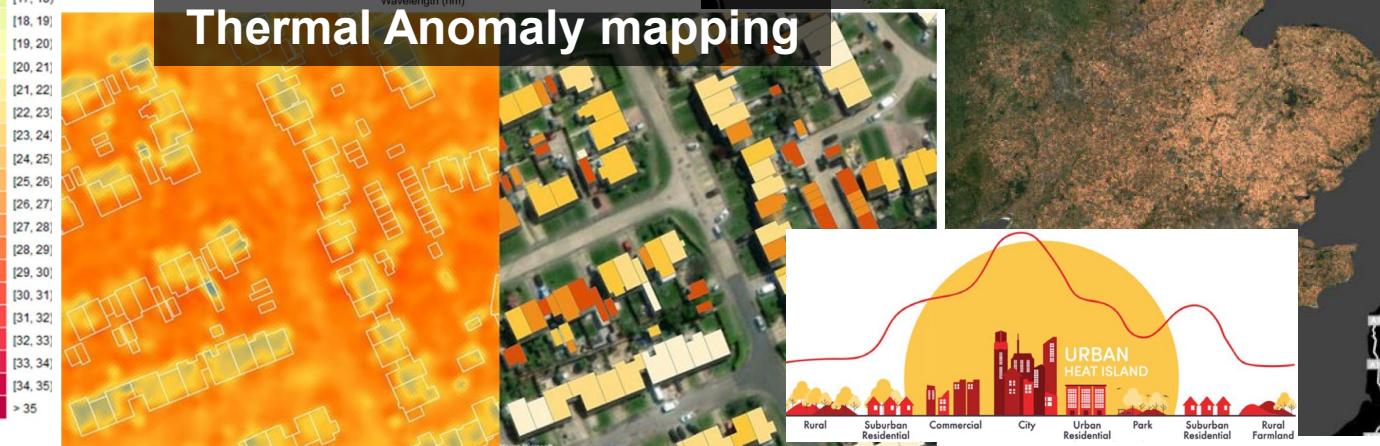


Figure 15 : visualisation of SatVu capabilities to distinguish heat loss from individual buildings

Interoperable on-demand services for GTIF



The figure displays three screenshots of the GTIF (Green Transition Information Factory) web interface, showing wind turbine detections in Austria. Each screenshot includes a map view, a detailed information panel, and a zoomed-in view of the detected turbines.

Screenshot 1: Shows a map of Austria with numerous blue circular markers indicating wind turbine detections. The information panel provides details about the "WIND TURBINE DETECTIONS" product, including the product name (Sentinel-2 Wind Turbine Detection), spatial resolution (Bounding Box), temporal reference (Autumn 2022 – Spring 2023), CRS (EPSG:4326 – WGS 84), value range (-), coverage (Austria 9° 5' - 46° 3', 17° 2' - 49° 0'), and a product description explaining the detection process using Sentinel-2 imagery and a state-of-the-art object detection neural network. It also notes that the model was trained using wind turbine locations from Open Street Map as a starting point.

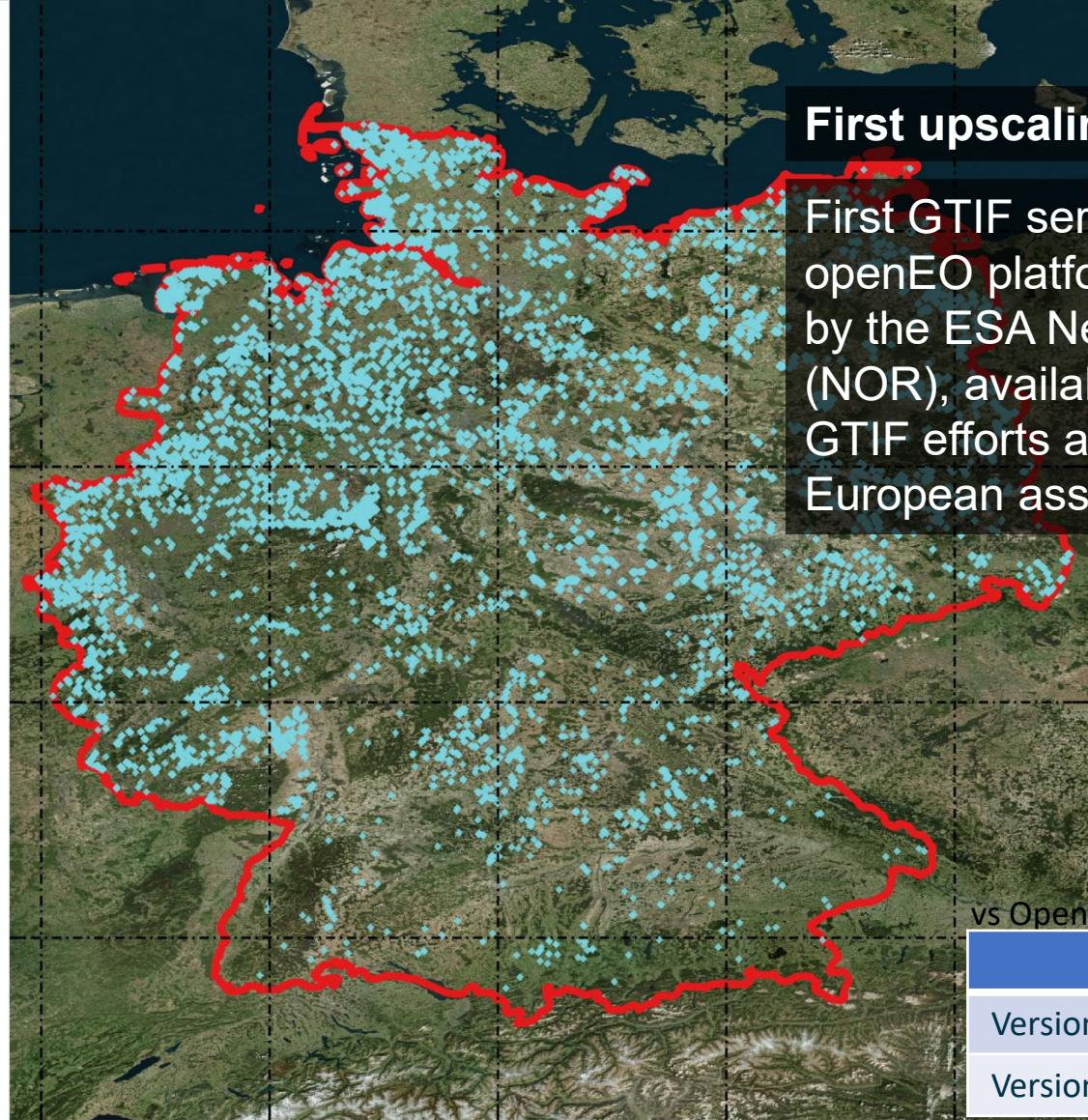
Screenshot 2: A zoomed-in view of a specific area in Austria, showing red rectangular markers over a satellite image. The information panel details the same product information as Screenshot 1, including the spatial resolution (EPSG:4326 – WGS 84), temporal reference (Autumn 2022 – Spring 2023), and coverage (Austria 9° 5' - 46° 3', 17° 2' - 49° 0').

Screenshot 3: Another zoomed-in view of the same area, showing red rectangular markers. The information panel provides the same product details, including a specific detection entry for id: 969 with confidence 0.924165725708008 and detection_time 20230112.

<https://gtif.esa.int/explore?indicator=REP6>

- Initial python implementation (DHI GRAS, DK), deep learning model using early/late seasonal Sentinel-2 imagery
- Detections precomputed for period autumn 2022 – spring 2023
- GTIF UI allows querying meta data (e.g. probability, detection date) and overlay of corresponding S2 imagery
- How can we support on-demand execution for various AOI/TOI and allow stakeholders/users to trigger updates of these products with direct integration into GTIF system?

GTIF Services: wind turbine detection on-demand



First upscaling result for Germany

First GTIF service, deployed in openEO platform, to be sponsored by the ESA Network of Resources (NOR), available to support future GTIF efforts and eventually pan European assessments.



	Recall	Precision
Version 1	0.901	0.867
Version 2	0.936	0.951

	Recall	Precision
Version 1	0.966	0.874
Version 2	0.960	0.924

Interoperable on-demand services for GTIF



(1) Algorithm implementation following interoperable community best-practices (i.e., openEO, STAC, OGC Application Packages)

```
import openeo
from openeo.processes import process

connection = openeo.connect("https://openeo.cloud")
connection.authenticate_oidc()

datacubeCropSAR = connection.datacube_from_process("CropSAR",
polygon = {"type": "Polygon", "coordinates": [[[19.95766264825904, 45.262257947054906], [11.58320016108509, 44.640742930016785], [11.099932251866536, 43.345601710375064], [9.650128524210867, 43.6640958553983], [9.386527846455289, 44.20167799638173], [9.95766264825904, 45.262257947054906]]]}, date = ["2023-08-01T00:00:00Z", "2023-09-01T00:00:00Z"], namespace = "\vito\")

result = connection.execute(datacubeCropSAR)
```

(2) Service integration in EO marketplaces

19 services available

Anomaly Det... VITO Regional Benchmarking using CropSAR No labels provided	Biomass VITO Dry Matter Productivity represents overall growth rates No labels provided	BIOPAR VITO Bio Physical Parameters No labels provided
Crop Calendar VITO Identifies a past harvest date for geometries No labels provided	CropSAR VITO Monitor crop growth and health from space No labels provided	Crop Type Cl... VITO Crop Type prediction model No labels provided
ESA WorldC... Jeroen's Org Download ESA WorldCereal Data No labels provided	MOGPR AI4FOOD Compute an integrated time series based on multiple inputs. No labels provided	MSI VITO Moisture Stress Index No labels provided

(3) On-boarding of service with ESA Network of Resources to benefit from sponsorship for any pre-commercial usage

NoR

Service Discovery About Web Portal Support

Offering ID	Description	Units	Duration	Cost
<input type="checkbox"/> Truck detection	Mapping and quantification of moving trucks using Sentinel-2, please specify total sqkm to be processed	1000 sqkm [Min 1,000] calculate area	-	€0.95
<input type="checkbox"/> CARD4L NRB	Normalised Radar Backscatter processing, please specify total sqkm to be processed	100000 sqkm [Min 100,000] calculate area	-	€1.00
<input type="checkbox"/> Automatic field delineation	This service generates automatic contours for agriculture parcels, given Sentinel-2 images Minimum order 50EUR	6250 sqkm [Min 6,250] calculate area	-	€50.00

European Open Science Cloud

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Search in catalogs Services Exact match

All CATALOGS PUBLICATIONS DATA SOFTWARE SERVICES DATA SOURCES TRAININGS INTEROPERABILITY GUIDELINES BUNDLES OTHER

openEO Platform



openEO Platform:

- Operational, federated cloud-based, and open-source EO analytics environment
- JupyterLab and web-editor for interactive development
- Intuitive front-end libraries in Python, JavaScript and R
- European excellence building on achievements of the H2020 openEO API
- openEO platform aims for optimal conformity with requirements of real-world EO users



Kick-off September 2020



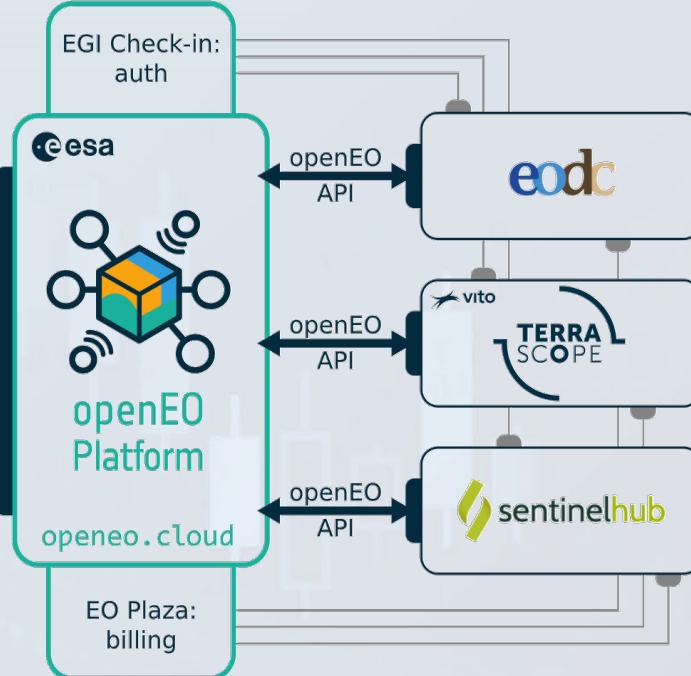
Operational service launched at
2021 ESA Phi Week



User Consultation and
classroom trainings at
ESA LPS 2022



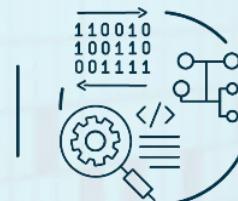
openEO
API



Agile
evolution
phase



Enabling simplicity



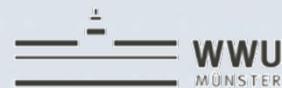
Pixel to continental
scalability



Community & Federation



Providing transparency



openEO processes provide optimised, high-level operators as building blocks

```
import openeo

connection = openeo.connect("openeo.cloud")
connection.authenticate_oidc()

l1c_cube = connection.load_collection(collection='SENTINEL2_L1C',
                                       spatial_extent=[9.256786, 44.505908, 14.970855, 47.526104],
                                       bands=['B01', 'B02', 'B03', 'B04', 'B05', 'B06', 'B07', 'B08', 'B8A', 'B09', 'B10', 'B11'],
                                       temporal_extent=["2023-03-09", "2023-03-19"])

ard_cube = l1c_cube.ard_surface_reflectance(atmospheric_correction_method = 'FORCE',
                                             cloud_detection_method = 'Fmask',
                                             elevation_model = "cop-dem-30m",
                                             atmospheric_correction_options = {"do_brd": "TRUE", "do_topo": "TRUE"},
                                             cloud_detection_options={'cld_prob': 0.225, 'cld_dil': 6, 'shd_dil': 6})
```

openEO platform – User Defined Process (UDP)



Processing script using openEO
python client library →

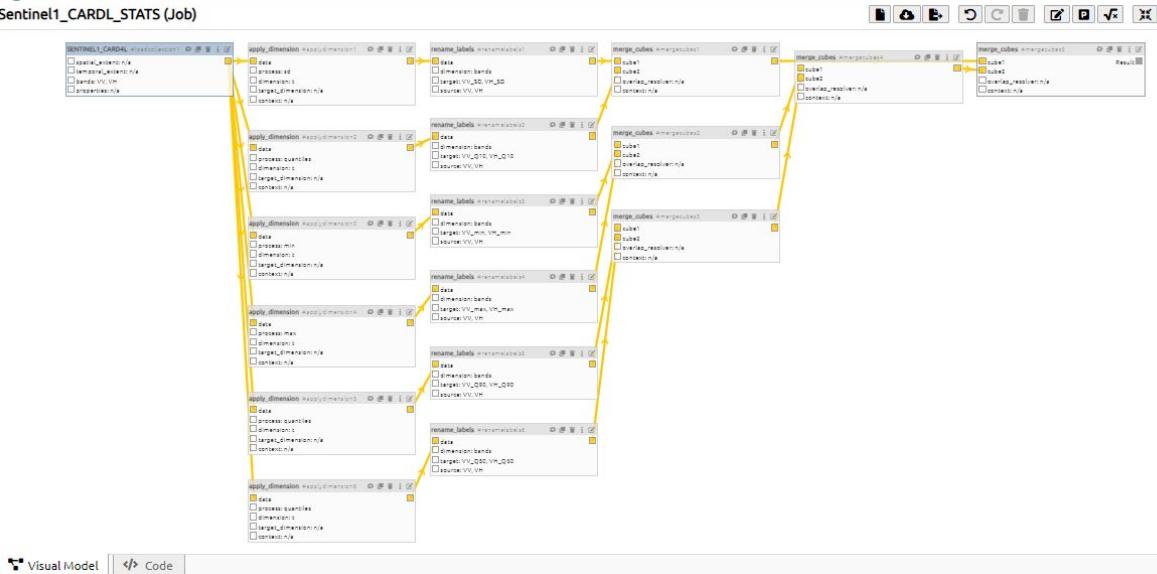
```
def get_stats(data: ProcessBuilder) -> ProcessBuilder:
    """
    Collect stats for `data` (to be interpreted as an array of values along the "t" dimension).
    We should return a new array with the stats.
    """

    # Put some scalar stats ('min', 'max', ... return a scalar value) in a new array
    scalar_stats = array_create([
        data.min(),
        data.max(),
        data.mean(),
        data.sd(),
    ])
    # The `quantiles` process returns an array on its own
    quantile_stats = data.quantiles([0.1, 0.5, 0.9])

    # Combine everything in a single array
    return array_concat(array1=scalar_stats, array2=quantile_stats)

s1_stats = s1_raw.apply_dimension(
    process=get_stats,
    dimension="t",
    target_dimension="bands",
)
# Rename band labels, pairing original band names with stat names
s1_stats = s1_stats.rename_labels("bands", [
    f"(b).{s}"
    for b in s1_raw.metadata.band_names
    for s in ["min", "max", "mean", "sd", "q10", "q50", "q90"]
])
```

Resulting openEO process graph in JSON and/or
graphical Web Editor representation



openEO process graphs

+++ Abstraction

+++ Interoperability

+++ Reusability

+++ Discoverability

```
{
  "process_graph": {
    "v12": {
      "arguments": {
        "cubel": {
          "from_node": "mergeall"
        },
        "cube2": {
          "from_node": "merge13"
        }
      },
      "process_id": "merge_cubes"
    },
    "apply1": {
      "arguments": {
        "data": {
          "from_node": "load1"
        }
      },
      "dimension": "t",
      "process": {
        "process_graph": {
          "max1": {
            "arguments": {
              "data": {
                "from_parameter": "data"
              }
            },
            "process_id": "max",
            "result": true
          }
        }
      }
    },
    "process_id": "apply_dimension"
  },
  "apply2": {
    "arguments": {
      "data": {
        "from_node": "load1"
      }
    },
    "dimension": "t",
    "process": {
      "process_graph": {
        "min1": {
          "arguments": {
            "data": {
              "from_parameter": "data"
            }
          },
          "process_id": "min",
          "result": true
        }
      }
    }
  },
  "process_id": "apply_dimension"
}
```



openEO platform – User Defined Process (UDP)



(1) Define parameters

```
spatial_extent = Parameter(  
    name="bbox",  
    description = "The bounding box to load.",  
    schema={"type": "object", "subtype": "geojson"}  
)  
  
temporal_extent = Parameter(  
    name="temporal_extent",  
    description = "The date range to load.",  
    schema={"type": "array", "subtype": "temporal-interval"},  
    default = ["2022-05-01T00:00:00Z", "2022-05-31T00:00:00Z"]  
)  
  
  
bands=["VV", "VH"]  
collection = "SENTINEL1_CARD4L"  
  
  
cube = connection.load_collection(  
    collection,  
    spatial_extent=spatial_extent,  
    temporal_extent=temporal_extent,  
    bands = bands)
```

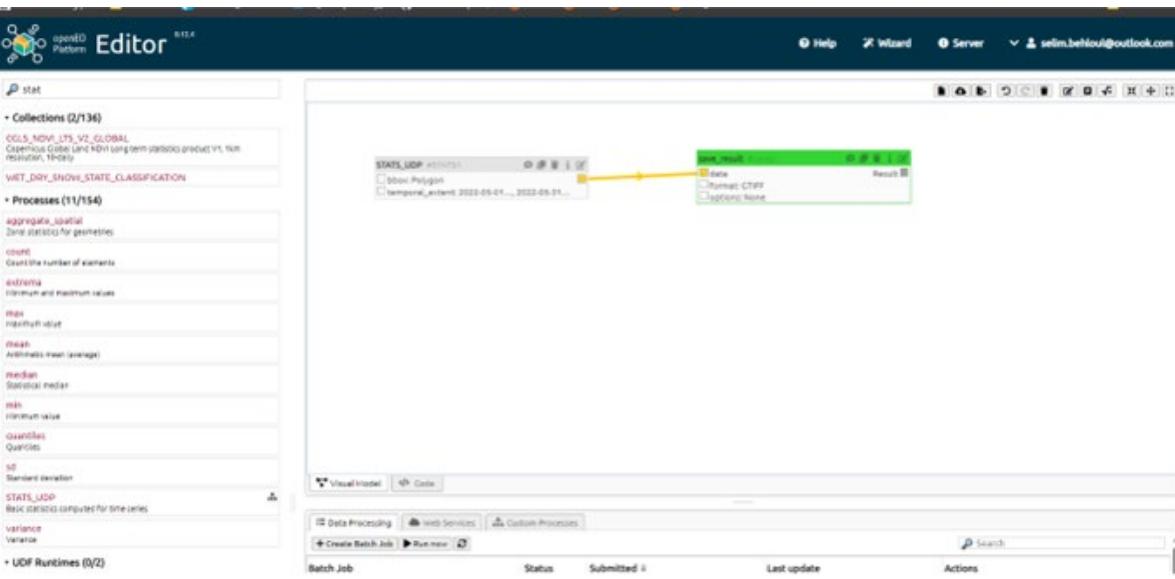
(2) Define and save UDP

```
[9]: process_name = "STATS_UDP"  
process_summary = "Basic statistics computed for time series"  
process_description = "max,min,SD,Q10,Q90,Q50"  
  
[10]: connection.save_user_defined_process(  
        user_defined_process_id=process_name,  
        process_graph=merge14,  
        description = process_description,  
        summary = process_summary,  
        parameters=[spatial_extent,temporal_extent],  
        public=True  
)
```

openEO UDP:
+++ Abstraction
+++ Interoperability
+++ Reusability
+++ Discoverability

(3) Run UDP

```
[22]: # Load the saved process and pass the values to the parameters  
process = connection.datacube_from_process(  
    process_id = "STATS_UDP",  
    temporal_extent = temporal_extent,  
    bbox = geometry)
```





APE_x

Application Propagation Environment

STREAMLINING FROM EO INNOVATION TO OPERATIONS

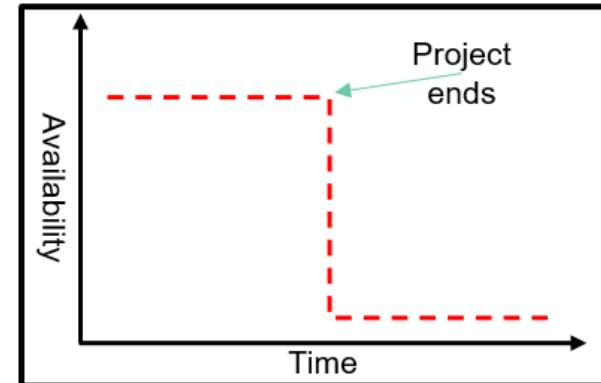
Background & Motivation



Observation 1: EO Application project results - especially algorithms & value-added products - become unavailable after a project ends.

Observation 2: No existing mechanism to transition prototype algorithms to operational services (aka “*last mile challenge*”).

Observation 3: Application projects spend considerable time and effort on setting up project environments for collaboration/data analysis/dissemination, constraining the effort dedicated to advancing applications.



FutureEO Independent Science Review 2022 recommendations:

Need for more visibility, discoverability and usability of science results, leveraging interoperability and Open Science Tools, and improving communication and community building.

Scientific community feedback at Science Strategy workshop (2023):

ESA to support FAIR and reproducible Open Science practices and complementing the scientific process by Software Development best practices.

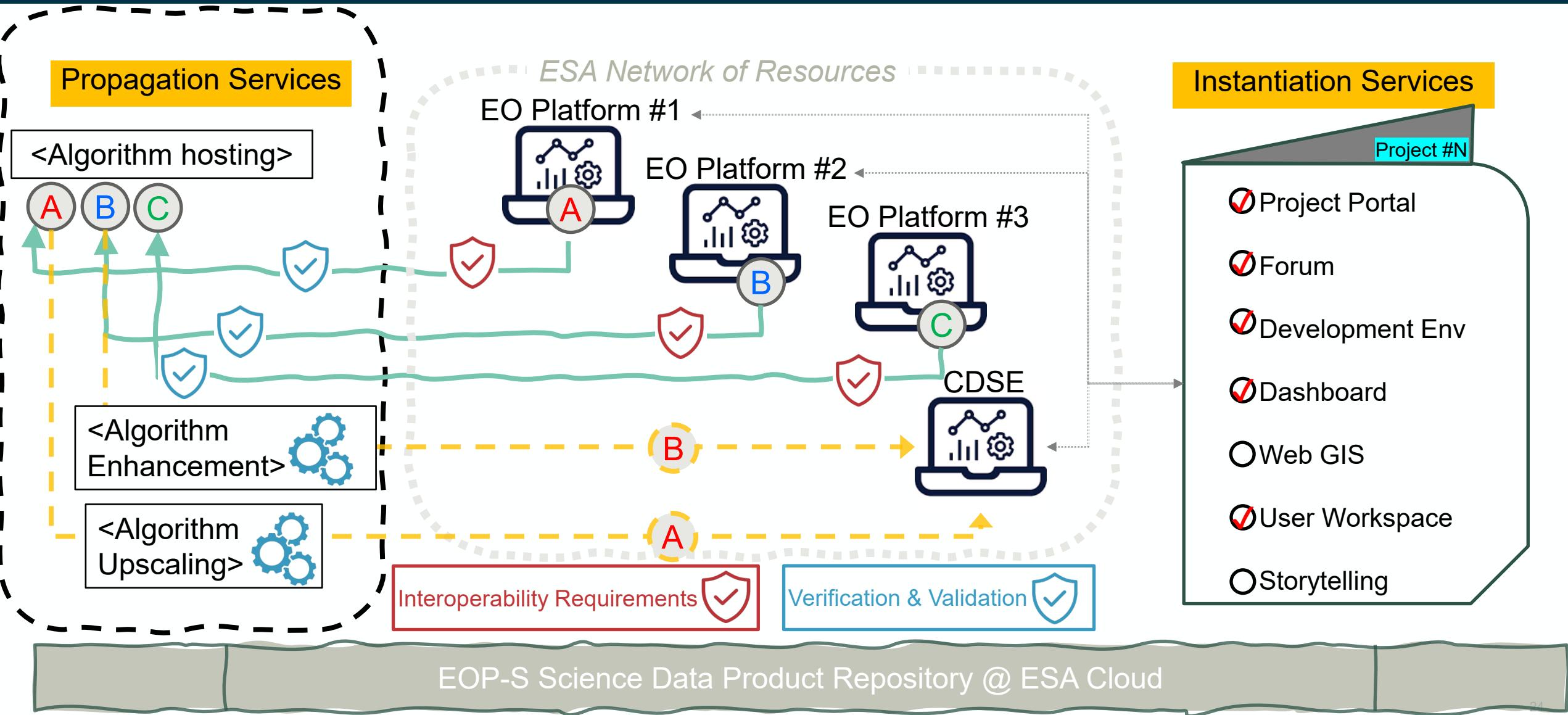
APEx will address these shortcomings & recommendations, primarily for ESA EOP R&D Application activities.



Application Propagation Environment (APEx)



- **APEx will enable better reuse & adoption of EO R&D results by providing a range of (cloud-based) instantiation and propagation services.** Rather than “*yet another platform*”, APEx will integrate, streamline and enhance existing European EO platforms services & provide interoperability requirements for contributing platforms.
- **Instantiation services:**
 - Rational: prevent reinventing the wheel, provide highly configurable working environments to R&D projects.
 - Functional scope: project portals, Interactive Development Environments, datacubes and dashboards as a service, federated data access, geospatial storytelling, executable tutorials, web-based visualisation environments, managed object storage and user workspaces.
- **Propagation services:**
 - Rational: streamline the hosting of R&D algorithms, foster reuse, increase algo computational efficiency
 - Functional scope: Algorithm Hosting, Upscaling service, Algorithm Enhancement service, Cloudification Service, Algorithm Intercomparison Service





→ Prime, operating openEO platform backends in TerraScope & CDSE
→ Leading: Project Management, System Architecture & Portal, Propagation Services, Communication & Outreach



BROCKMANN
CONSULT

→ Leading: algorithm optimisation, toolbox cloudification, algorithm intercomparison



→ Leading: Infrastructure engineering & optimisation, operations, instances deployment, user management, service monitoring,



→ Leading: Dashboards & web-based visualisation environments



→ Leading: Instantiation services (IDE, Workspace), Algorithm hosting, Algorithm Upscaling

- Kicked off in April 2024, phase-in 6 months, operational phase: 18 months
- 7.5MEUR over 2+3 years, 300kEUR LOL per year, budget contribution from SUP

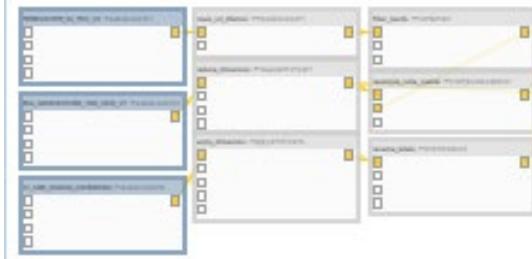
APEx Propagation Services (1)



Algorithm hosting:

- Provide interoperability/compliance guidelines specifying how science teams should implement algorithms as (standardised) FAIR compliant, cloud-based, services.
- Algorithm provider can choose a hosting environment (EO platform from Network of Resources).
- Aggregate hosted algorithms in APEx portal (GUI and API execution) and continuously monitor their availability and functioning.

openEO Process Graphs & User Defined Processes



```
1  {
2   "process_graph": {
3     "aggregatetemporalperiod1": {
4       "arguments": {
5         "data": {
6           "from_node": "filterbands2"
7         },
8         "period": "dekad",
9         "reducer": {
10          "process_graph": {
11            "mean1": {
12              "arguments": {
13                "data": {
14                  "from_parameter": "data"
15                }
16              },
17              "process_id": "mean",
18              "result": true
19            }
20          }
21        },
22        "process_id": "aggregate_temporal_period"
23      },
24      "aggregatetemporalperiod2": {
25        "arguments": {
26          "data": {
27            "from_node": "mask2"
28          },
29          "period": "dekad",
30          "reducer": {
31            "process_graph": {
32              "mean2": {
33                "arguments": {
34                  "data": {
35                    "from_parameter": "data"
36                  }
37                }
38              }
39            }
40          }
41        }
42      }
43    }
44  }
```

Application Packages

OGC Best Practice for Earth Observation Application Package



kubernetes



26

APEx - Codeless on-demand services



← Go back to service selection

Execute - mogpr_s1_s2

Job title

FuseTS - MOGPR S1 S2

polygon*
Polygon representing the AOI on which to apply the data fusion

Polygon 1 1879.12 ha Delete

date*
Date range for which to apply the data fusion

2023-01-01 2024-01-01

s1_collection
S1 data collection to use for fusing the data

RVI ASC
RVI ASC
RVI DESC
GRD ASC
RVI DESC
GAMMA0
COHERENCE

Profile Analytics

ndvi_enmapbox_stack [column 309, row 222]

A

1
0.8
0.6
0.4
0.2
0

0 20 40 60 80 100 120

Band Number

APEx Propagation Services (2)



Algorithm upscaling:

- Allow users to apply algorithms over very large spatial (/temporal) data volumes
- Enable continental level upscaling while abstracting all data management aspects (e.g. tiling, parallelisation, node allocation, intermediate/result file handling)



title	status	id	start_time	cpu	memory	duration	input_pixel
Cropclass-Classification-E392N288-91.03	finished	j-0dbe5ab3dff44479a6cc9cb685826a6d	2022-12-19T20:43:14.094920	165856 cpu-seconds	171359107 mb-seconds	1452 seconds	2902.75 mega-pixel
Cropclass-Classification-E388N282-88.56	finished	j-9a8c65b21174c4b8e8d529e9802d697c9a	2022-12-19T20:45:45.741481	120572 cpu-seconds	126472362 mb-seconds	2912 seconds	2734.25 mega-pixel
Cropclass-Classification-E420N246-88.52	finished	j-b2bad6eaefac433898e988f0425394ce	2022-12-19T20:48:16.374673	95380 cpu-seconds	99735296 mb-seconds	2268 seconds	2415.625 mega-pixel
Cropclass-Classification-E388N286-88.25	finished	j-7ded8d6a7aaee43fcfa30fc1590f3f37a3	2022-12-19T20:50:55.611642	105093 cpu-seconds	110058459 mb-seconds	2472 seconds	2831.5 mega-pixel
Cropclass-Classification-E390N286-87.45	finished	j-b6d1a3305a1a4beab30330af680a5da0	2022-12-19T20:53:25.838270	109188 cpu-seconds	114388169 mb-seconds	2508 seconds	2783.8125 mega-pixel
Cropclass-Classification-E390N292-87.12	finished	j-e438fa8b7a7d4bda9f6223751f469ad8	2022-12-19T20:56:05.142620	115986 cpu-seconds	121365899 mb-seconds	2530 seconds	2844.9375 mega-pixel
Cropclass-Classification-E326N186-85.83	finished	j-4bb9ba7a6bae4768bf9df523add48392	2022-12-19T21:36:58.094683	149872 cpu-seconds	154693067 mb-seconds	1165 seconds	3191.875 mega-pixel
Cropclass-Classification-E294N172-85.77	finished	j-65940d078dbc43eaad7bb4fa0a5792a	2022-12-19T21:39:29.541656	91731 cpu-seconds	96505510 mb-seconds	2805 seconds	1778.0 mega-pixel
Cropclass-Classification-E382N300-84.76	finished	j-df4abf0bc3eb4ae6a4459c74860ae7e6	2022-12-19T21:42:02.834427	93295 cpu-seconds	98074063 mb-seconds	2621 seconds	2434.1875 mega-pixel
Cropclass-Classification-E380N302-84.50	finished	j-6a353a88f656446aba75981b1b6296cf	2022-12-19T21:44:32.431066	97908 cpu-seconds	102926781 mb-seconds	2595 seconds	2574.6875 mega-pixel
Cropclass-Classification-E330N188-83.83	finished	j-7cf61a04d70e48998143fb9fbfa756b	2022-12-19T21:47:03.381141	106536 cpu-seconds	111295127 mb-seconds	2692 seconds	2756.3125 mega-pixel
Cropclass-Classification-E384N282-83.10	finished	j-8abcc188c305493783ccd17aeb804c7b	2022-12-19T21:50:38.937058	85332 cpu-seconds	89383896 mb-seconds	2291 seconds	2694.1875 mega-pixel
Cropclass-Classification-E380N298-82.01	finished	j-703bd8e9a15040618a310777d50060c9	2022-12-19T21:58:15.841016	90333 cpu-seconds	94603474 mb-seconds	2041 seconds	2519.9375 mega-pixel
Cropclass-Classification-E320N194-81.41	finished	j-5d9387af8b6f44218567d1d6f3de6517	2022-12-19T22:27:28.034407	119534 cpu-seconds	124350696 mb-seconds	1889 seconds	1411.8125 mega-pixel
Cropclass-Classification-E320N196-81.21	error	j-e9189fe1f8ef4463a94e5cbc4c6ce9a5	2022-12-29T08:13:33.921930	814 cpu-seconds	3270117 mb-seconds	130 seconds	<null>
Cropclass-Classification-E318N188-81.03	finished	j-3852d942d99648c2a99d66f9e6e4cff	2022-12-19T22:33:46.599721	104708 cpu-seconds	109510246 mb-seconds	2294 seconds	1816.125 mega-pixel
Cropclass-Classification-E388N284-81.00	finished	j-fdcfce20cd04e98888e2a336b04a9be	2022-12-19T22:36:15.858334	126983 cpu-seconds	132099024 mb-seconds	1998 seconds	2712.25 mega-pixel
Cropclass-Classification-E314N192-80.98	finished	j-73b5fa827faf40b6a8ded4230cf35e94	2022-12-19T22:38:46.437645	103568 cpu-seconds	108477959 mb-seconds	2358 seconds	2438.875 mega-pixel
Cropclass-Classification-E376N296-80.84	finished	j-42a99c267cdc41c6b071b77433055c27	2022-12-19T22:41:25.157650	74831 cpu-seconds	78622656 mb-seconds	2199 seconds	2313.5625 mega-pixel

ESA Network of Resources (NoR)



- The Network of Resources (NoR) is an initiative of ESA to increase the exploitation of EO data in (European) cloud environments
- Support transition of “users to the data” paradigm
- Support new EO platform providers with revenue stream and real-world users and their feedback

Good starting point to understand the background and sponsorship process/criteria:

- <https://eo4society.esa.int/network-of-resources>
- <https://eo4society.esa.int/network-of-resources/nor-sponsorship/>
- <https://nor-discover.cloudeo.group/>



WHAT IS THE NETWORK OF RESOURCES

The increasing size of available satellite mission data sets, together with Information Computer Technology (ICT) advances has resulted in a paradigm shift. Data do not need any more to be downloaded by the user to their local machine for further processing, on the contrary it is the user who can find the data and process them in cloud environments hosted by ICT providers with expandable processing capabilities.

The Network of Resources (NoR) is an ESA initiative to facilitate the use of cloud environments by users, building on and enlarging the previous Open Science for Earth Observation (OSEO) call.

The NoR call supports research, development and pre-commercial users to innovate their working practices, moving from a data download paradigm towards a bring the user to the data paradigm, considered essential for maintaining competitiveness of European data exploitation.



NoR Sponsorship

The NoR call aims to support research, development and pre-commercial users to innovate their working practices, moving from a data download paradigm towards a ‘bring the user to the data’ paradigm, considered essential for maintaining competitiveness of European data exploitation. The NoR Discovery Portal provides an ever increasing portfolio of innovative operational platform and cloud services operated by actors from participating countries¹. Usage of these resources shall accelerate the achievement of scientific goals and the sharing of the results, or to approach the digital information market quicker and in an easier sustainable way.

The NoR will provide successful applicants with a voucher for the selected services, allowing free-at-point-of-use consumption for research, product development and up to pre-commercial demonstration. Vouchers must not be used to support any commercial revenue flows.



Discovery Portal



Sponsorship

Network of Resources - Resources



Guidance: <https://nor-discover.org>

NoR

774 Approved projects

NoR provides non-commercial and commercial users with a unique environment to discover European cloud services and their estimate costs for Earth Observation exploitation.

ESA offers sponsorship to eligible entities to cover the costs of trying out the various services. Cloud providers can apply to be included in the [NoR Portfolio](#) by replying to the open call.

But have a look for yourself ...

25 Providers onboarded

Project Map: <https://map.nor-discover.org>



Portfolio: <https://nor-discover.cloudeo.group/>

Text Search Q

Filters Applied: 1 X

AlgoHosting (1)

Matching Services: 13

+ Service Type

A service may offer several service types

- Any
- Analytics (1) 1
- AlgoHosting (1) 1
- DPaaS (19) 19
- IaaS (19) 19
- IDE (11) 11
- Auxiliary Services (6) 6

+ Source

+ Geographical Coverage

+ Temporal Period

€ Compare Pricing

WASDI

VTT - Forestry TEP

EOX IT Services - EOXHub

Progressive Systems Srl - EarthConsole

Project Details: <https://eo4society.esa.int/nor-projects/>

Automated Parcel Delineation	ICRISAT-Senegal	Senegal	Agricultural field delineation is desirable for the operational monitoring of agricultural production and is essential to [...]	Not yet available
Automatic 3D surface reconstruction using modern techniques	Researcher	United States of America (the)	Digital Surface Models (DSMs) are digital representations of the Earth's surface that can be created using various [...]	Not yet available
Automatic detection of changes in building stock through the use of satellite	University of Applied Sciences	Germany	This master's degree project carried out by the University of Applied Sciences aims to improve the quality of cadastral data [...]	Report
Availability of public green open space and its relation to thermal comfort level	Universitas Negeri Semarang	Indonesia	This research is one of the requirements to complete my studies at the State University of Semarang. The theme I took was the [...]	Not yet available

openEO platform – NOR sponsorship



SERVICE OFFERING

openEO platform aims at covering the needs of real-world EO users and experts. Therefore, we invite you to join the development and evolution process! Play around with the platform using the free trial or apply for Network of Resources Sponsoring for running larger use cases. We'd love to hear your feedback and get to know the features and capabilities that you need! The following offers are available right now:

Free Trial
free
You want to try and "play" with the Platform. You don't have a specific use case in mind and want to see how it works.
Valid for: 30 days

Network of Resources Sponsoring
free
You want to use openEO Platform for longer running projects or get specific support from our development team for your workflows. Limited funding (5,000 EUR) for non-ESA projects.
Valid as per sponsoring request

Offering ID	Details
Early adopter	Basic subscription for maximum of 3 months
Basic	Subscription with 10,000 credits per month
Advanced/Professional	Subscription with 60,000 credits per month
University student	Single account with community forum support, 5,000 credits per month Minimum Subscription 12 months
University & Research Institute	Subscription with 5 accounts, Forum support within 5 NWD, 40,000 credits per month Minimum Subscription 6 months
Offering ID	Details
Extra credits	100,000 extra credits
Standard Training	30 users for a total period of 4 weeks Non-commercial/research, including a setup training, 10,000 credits per user
Bronze support	4 days - Small features, optimising user code, Platform consultancy, consumed within 1 year
Silver support	10 days - Small features, optimising user code, Platform consultancy, consumed within 1 year

It is possible to apply for Network of Resources Sponsoring after your free trial period if you find openEO Platform useful for a newly developed idea.



Permanently Open Call



- ❖ Activity lines: Science, Applications, Industrial competitiveness, **Digital Innovation**, Sentinel Users Preparation, Foresight.

- ❖ Two proposal categories:

1. Regular innovative activities up to 200 kEur for 18 months.
2. Fast innovative activities, up to 100 kEur for 6 months.

- ❖ Digital Innovation:

Proposals shall address the creation of **innovative, cloud-based capabilities** that are made available to the community as ready-to-use and interoperable platform services and should become part of the ESA Network of Resources initiative. Proposed activities should build on public European cloud infrastructures, employ **cloud-native technologies and open-source geospatial software stacks**. Activities may integrate **cross-cutting technologies** such as e.g. in-situ, IoT, citizen science and advanced visualisation/frontend technologies to strengthen their innovative potential. Solutions that foster an **interactive user experience** e.g., for code development, analytics, machine learning/AI or capacity building are also encouraged. Relevant are also **FAIR data principles and open science best practices**. Activities leveraging the existing digital innovation ecosystem platforms to roll out third party applications related to the Green Deal are also explicitly encouraged. All proposed activities shall support the preservation of science/application results to the community, contribute to a European interoperability Federation and to the evolution of open-source platform building blocks.



Batch	Submission deadline
Batch 1	31 October 2023, 13:00 hours (Amsterdam time zone)
Batch 2	30 January 2024, 13:00 hours (Amsterdam time zone)
Batch 3	30 May 2024, 13:00 hours (Amsterdam time zone)
Batch 4	30 September 2024, 13:00 hours (Amsterdam time zone)
Batch 5	30 January 2025, 13:00 hours (Amsterdam time zone)
Batch 6	30 May 2025, 13:00 hours (Amsterdam time zone)
Batch 7	30 September 2025, 13:00 hours (Amsterdam time zone)

<https://eo4society.esa.int/2023/09/15/future-eo-1-segment-2-open-call-for-proposal-for-eo-innovation/>

openEO platform - resources

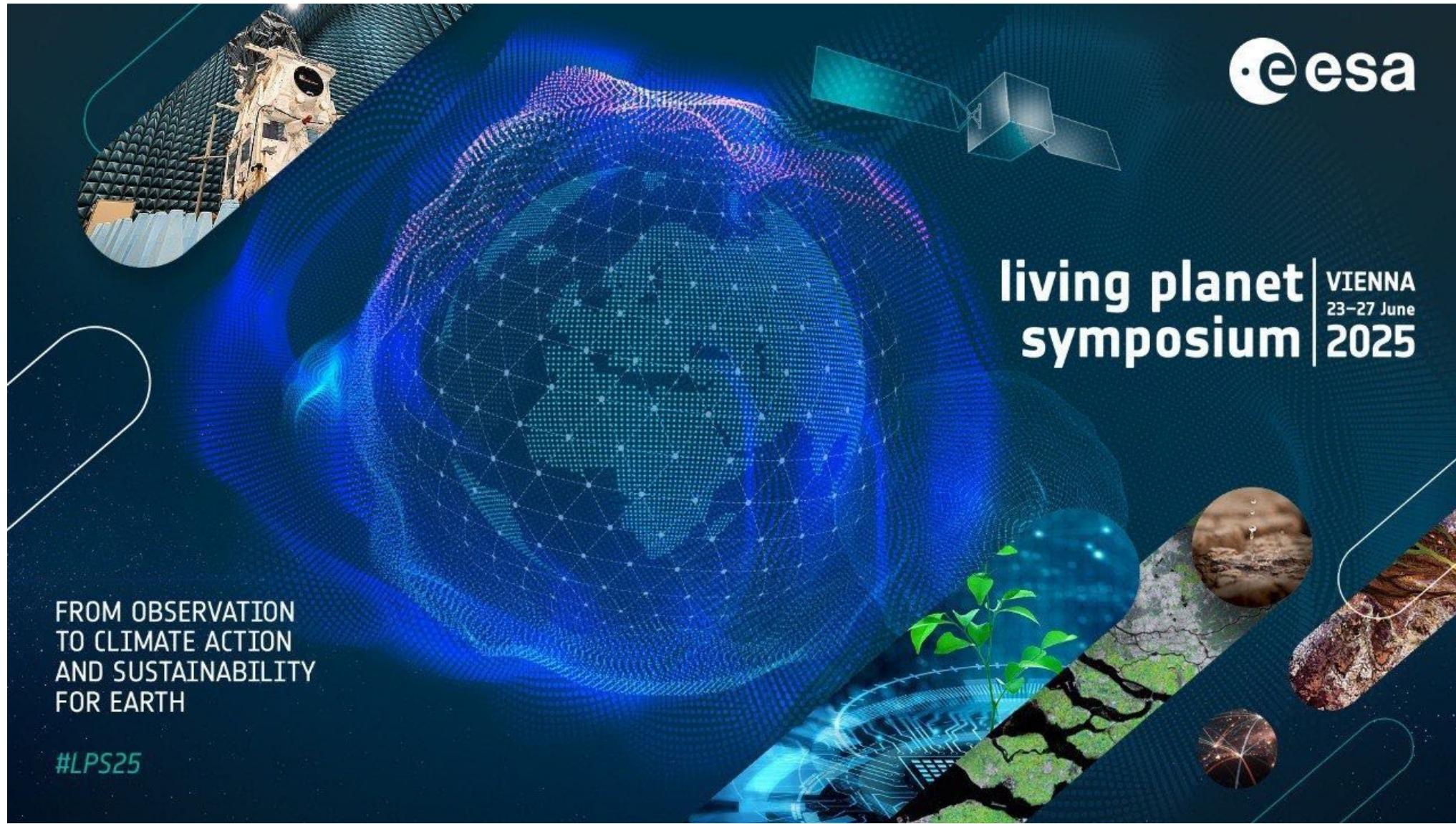


- ❖ Platform portal: <https://openeo.cloud/>
- ❖ Web editor: <https://editor.openeo.cloud/>
- ❖ Jupyter lab: <https://lab.openeo.cloud/>
- ❖ user forum: <http://forums.openeo.cloud/>
- ❖ documentation: <https://docs.openeo.cloud/>
- ❖ GitHub: <https://github.com/orgs/openEOPlatform/repositories>
- ❖ docs section on virtual datacubes:
<https://openeo.org/documentation/1.0/datacubes.html>
- ❖ openEO (h2020) cookbook:
<https://openeo.org/documentation/1.0/cookbook/#input-load-collection>



- GTIF: <https://gtif.esa.int/>
- APEx:
 - https://github.com/ESA-APEx/apex_documentation
 - <http://apex.esa.int> (under development)
- ESA Network of Resources: <https://nor-discover.org/en/portfolio/>
- EODASH: <https://github.com/eurodatacube/eodash>
- Open Call: <https://eo4society.esa.int/2023/09/15/future-eo-1-segment-2-open-call-for-proposal-for-eo-innovation/>
- ESA EOP FutureEO Science for Society: <https://eo4society.esa.int/>

See you at LPS25



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+ THE EUROPEAN SPACE AGENCY



Thanks for listening!

Patrick.Griffiths@esa.int

