




SE 5.34 MM

RMSE 5.34 MM

Terrascope

ESA CollGS Workshop Oct 2021

 @Terrascope_BE

www.terrascope.be

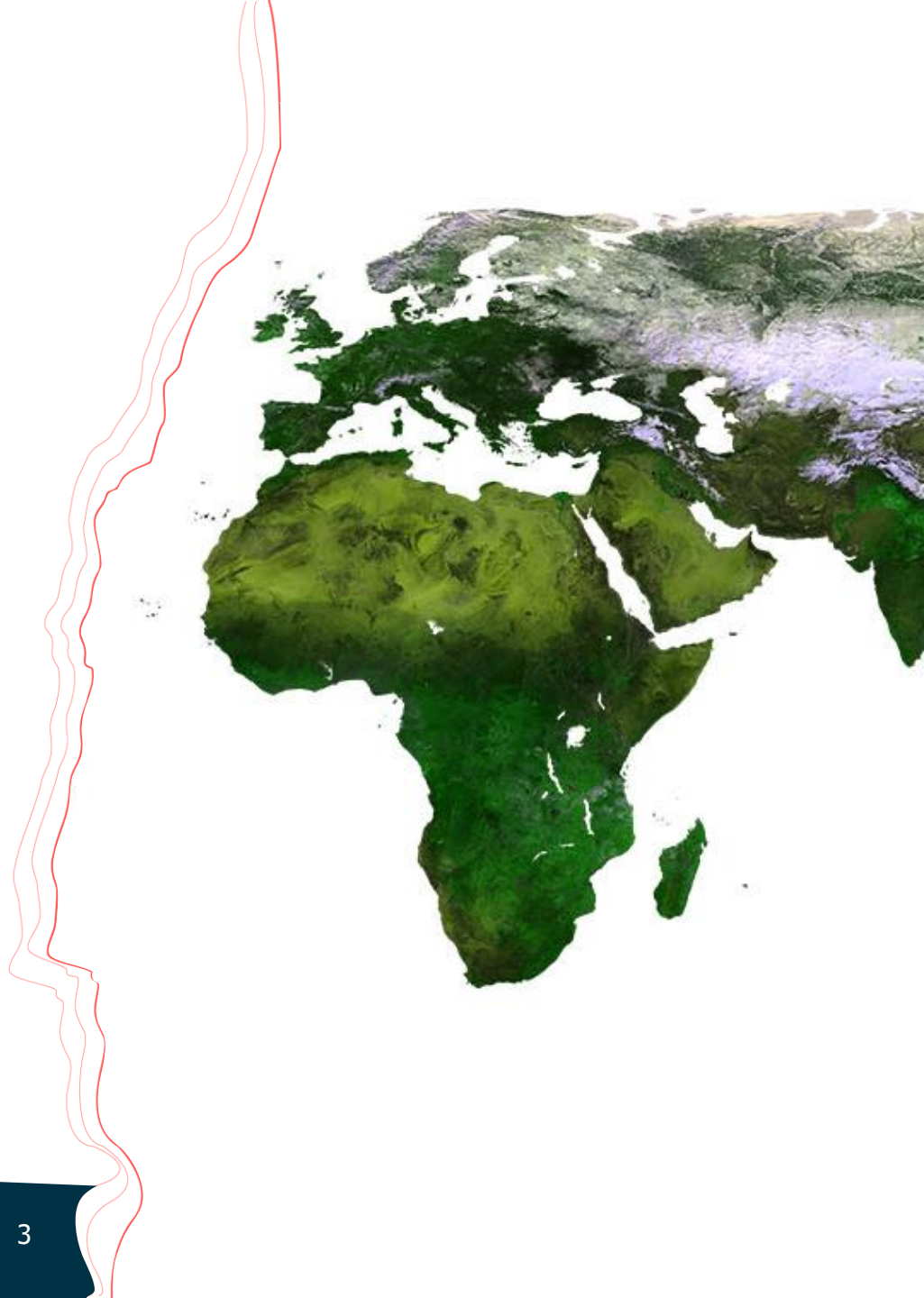
Dennis Clarijs

Terrascope

- Belgian CollGS agreement signed Sept 2017 with BELSPO
- VITO is designated entity in Belgium
- Platform released from March 2018 onwards
- Onboarded in Network of Resources in 2020

Terrascope highlights

- **Focus on Analysis Ready Data (ARD)**
 - Preprocessed added value products & analysis tools
 - On-demand datasets
 - Converted to COG format and INSPIRE metadata compliancy
- **Unique long term global vegetation datasets**
- **Strong BE user focus**
 - Services, cloud processing to enable users to build upon
 - Road shows, user onboarding, tutorials, webinars, MOOC
 - Free & open tier and funding opportunities
- **Federated node in EU infrastructure**



Terrascope available datasets

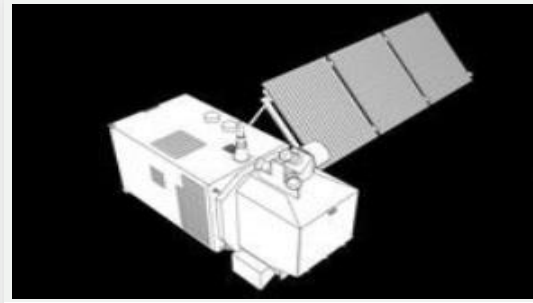
NATIVE DATASETS



Sentinel-1

Benelux area

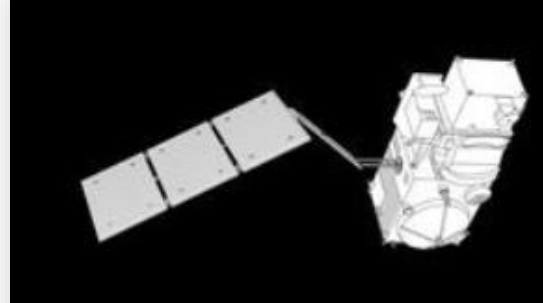
- Full archive
 - GRD; GRD-0
 - SLC; Coherence



Sentinel-2

Europe/selected regions

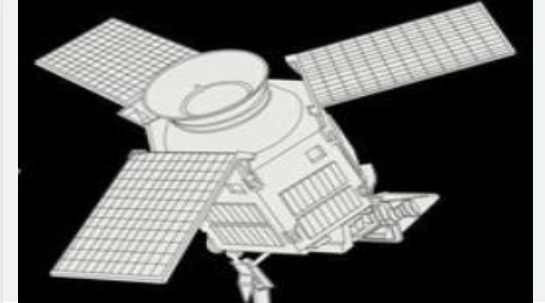
- Full archive for Benelux
- 2Y rolling archive for EU
 - L2A TOC
 - Vegetation indices



Sentinel-3

Global

- Full archive
 - SYN-VGT
 - To be released



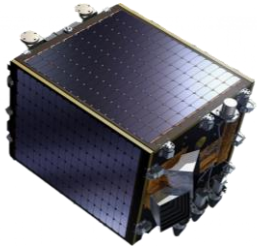
Sentinel-5p

Global

- 2018 - present
 - NO2
 - CO
 - (HCHO)
 - (CH4)

Terrascope available datasets

NATIVE DATASETS



PROBA-V

Global

- Full archive
 - L1C
 - L2A
 - 100 m, 300 m, 1 km
 - L3 products
 - 100 m, 300 m, 1 km



SPOT VEGETATION

Global

- Full archive
 - P products
 - Level 3 products



Global Land Service

Global

- Full archive
 - LAI
 - FAPAR



Copernicus DEM

Global

- 30 m
- 90 m

Terrascope interfaces



Terraviewer

Novice users

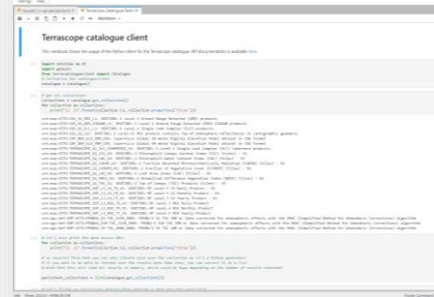
- Viewing
- Comparing
- Time lapses
- Downloads
- Time series analysis



Virtual Machines

Expert users

- NFS File access
- Wide Open source toolset
- Access to HPC



Jupyter Notebooks

Expert users

- Use Python/R/Scala
- Access to HPC



Web Services

Expert users

- WMT/WMTS
- OpenSearch Catalogue

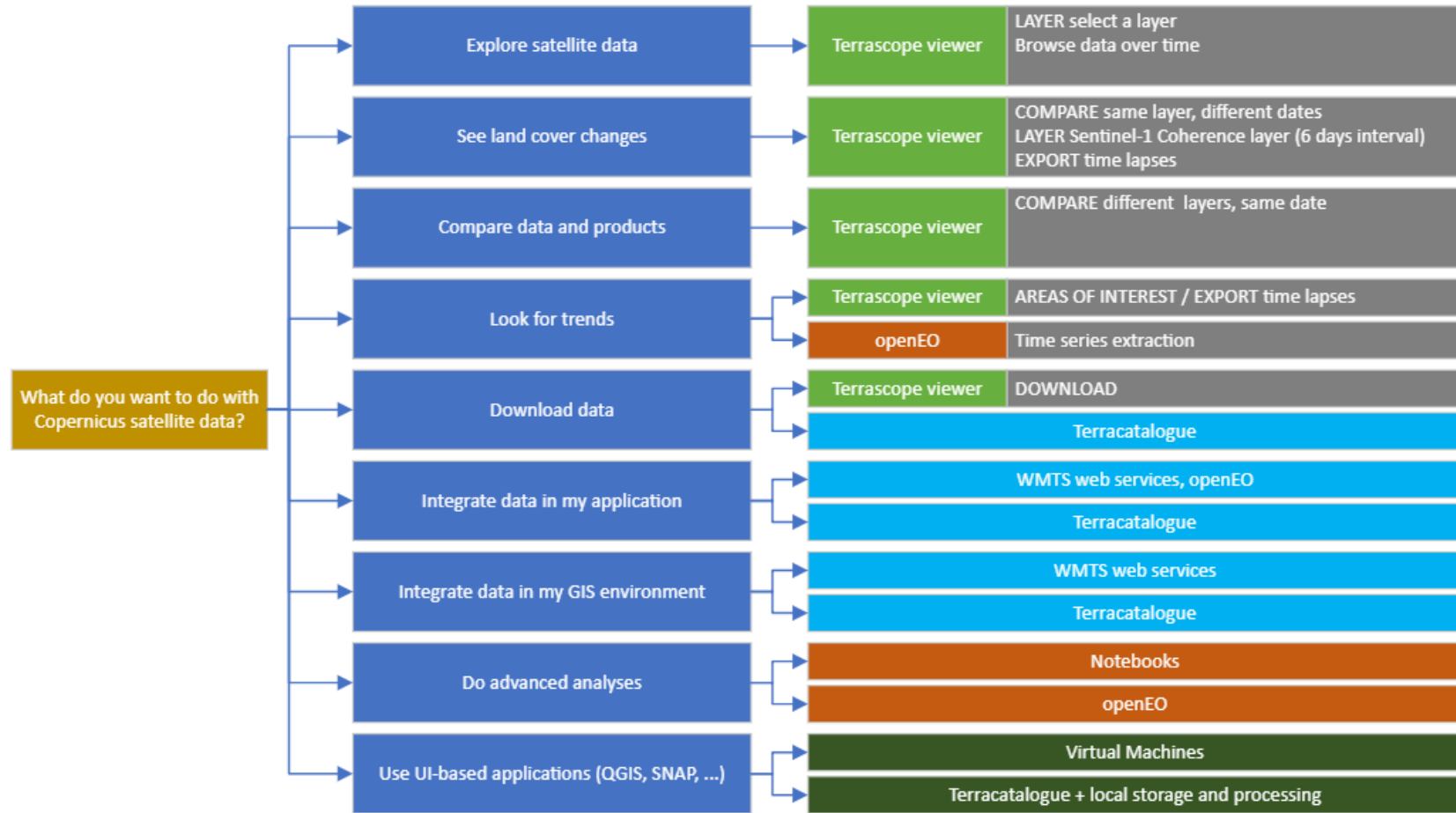


OpenEO API

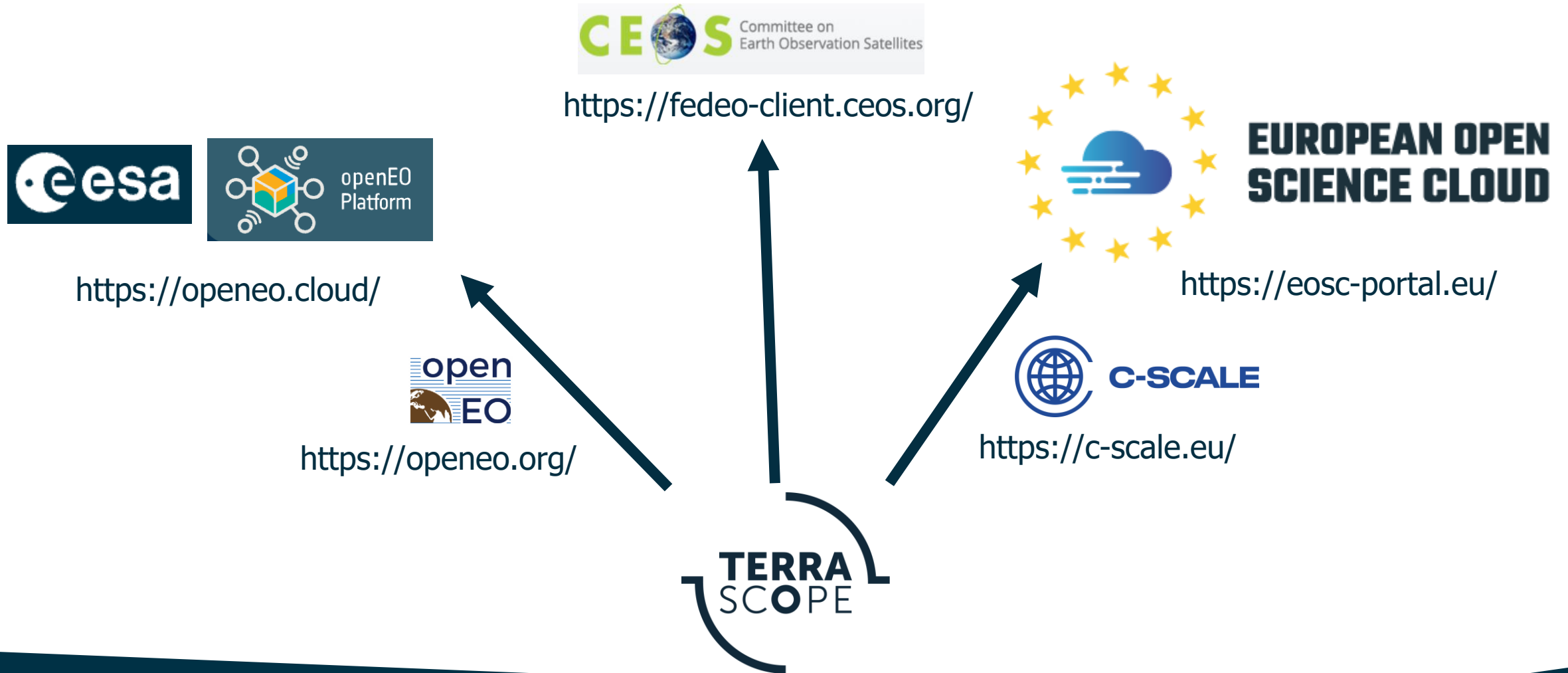
Expert users

- Platform independent
 - ▶ Datacube technology
 - ▶ Processing capabilities
 - ▶ Custom scripting on R/Python/JS
 - ▶ Connection to other back-ends

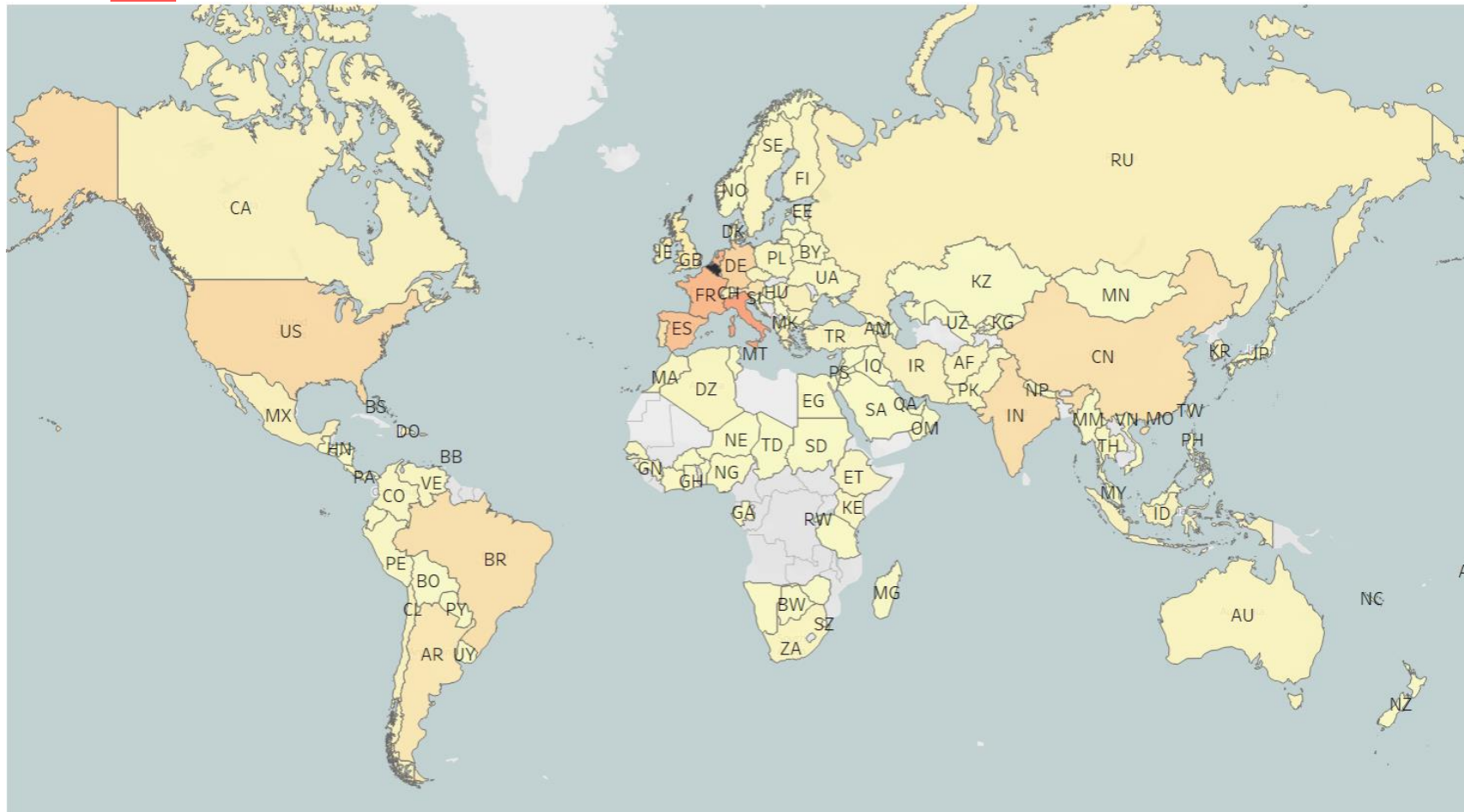
Terrascope exploration possibilities



Terrascope in a federated EU ecosystem



Terrascope Statistics

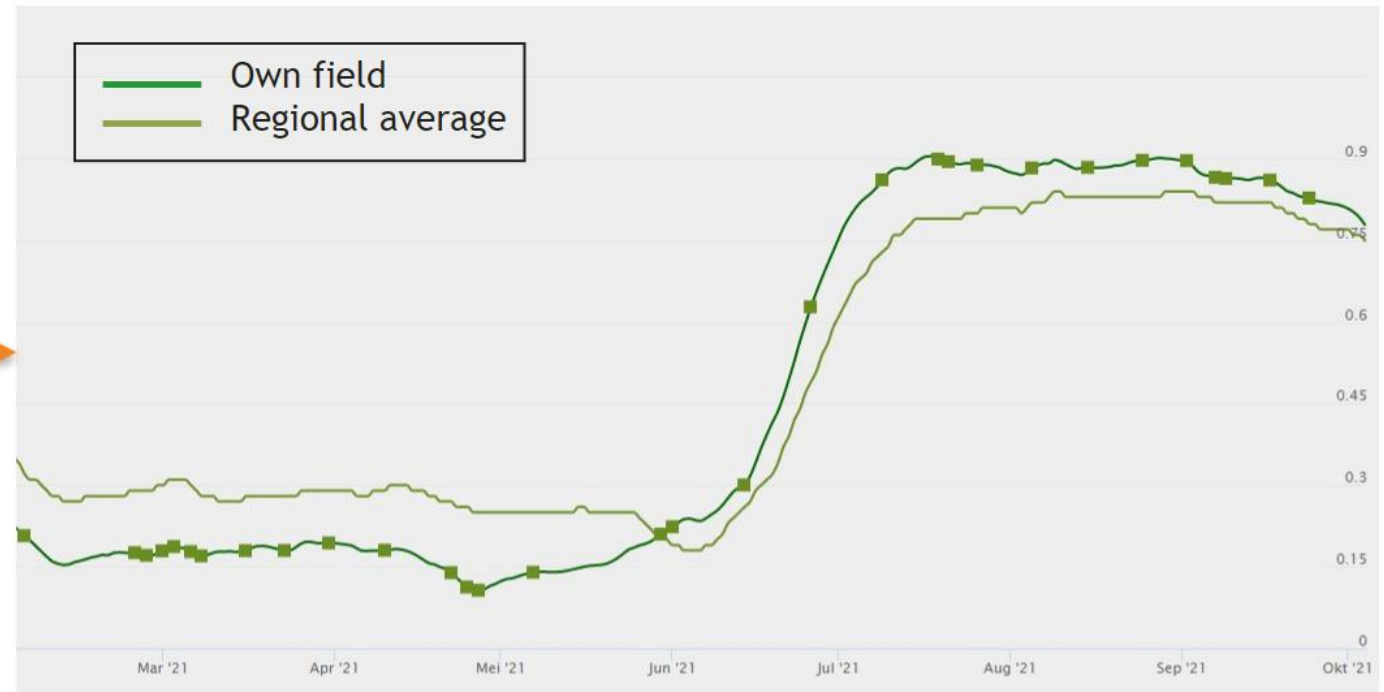
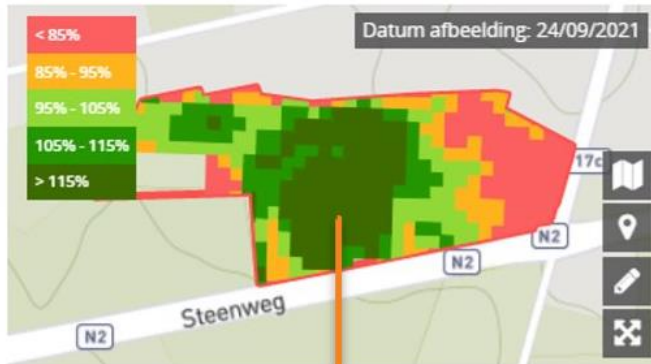


Platform visitors: 10000+
Registered active users: 1800+
Nationalities: 125

Datasets: 31
Online data capacity: 7.5 PB
VM capacity: +-500

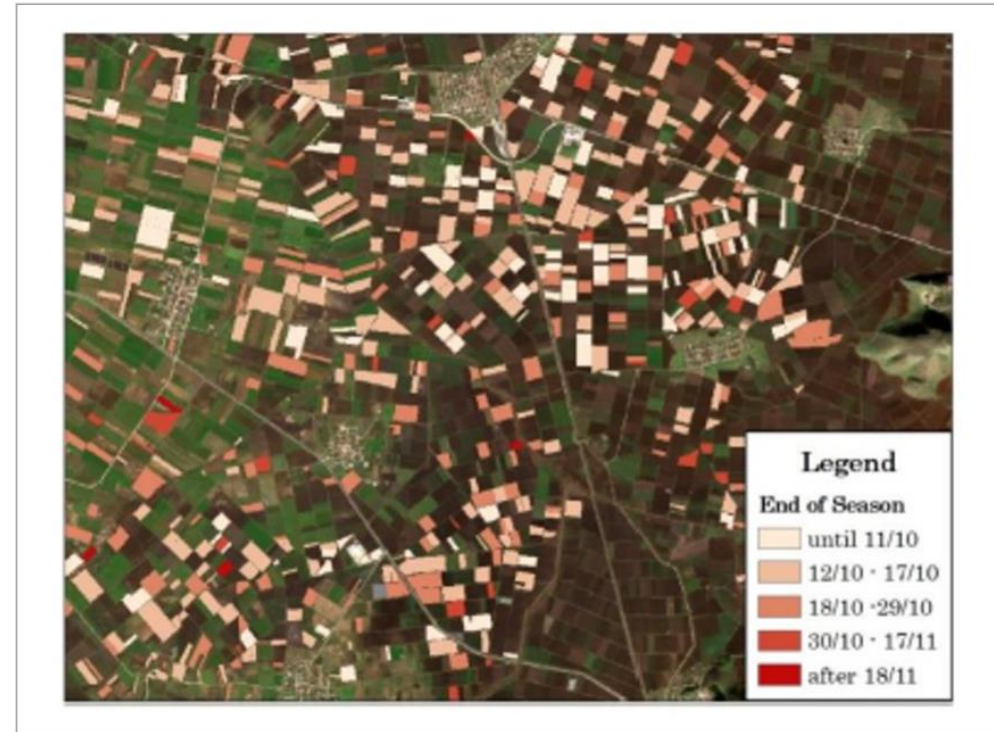
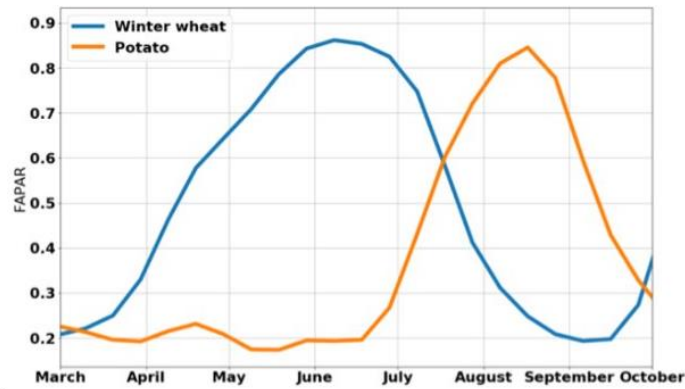
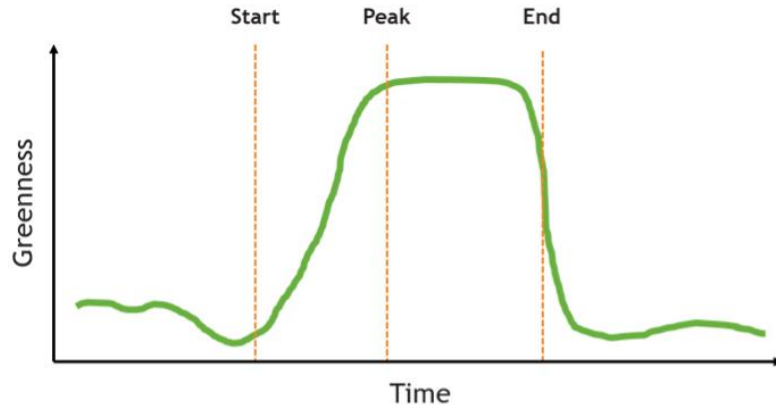
Use cases

YIELD PREDICTION BASED ON SENTINEL-1 AND 2 DATA FUSION WITH CROPSAR SERVICE



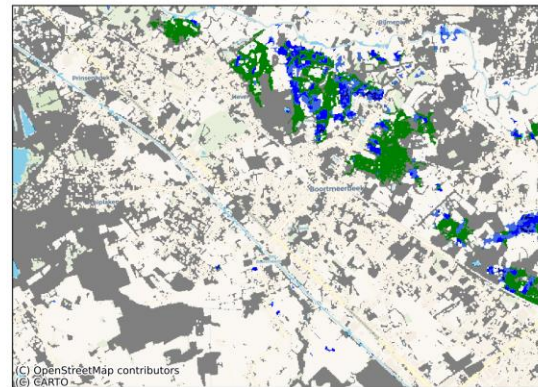
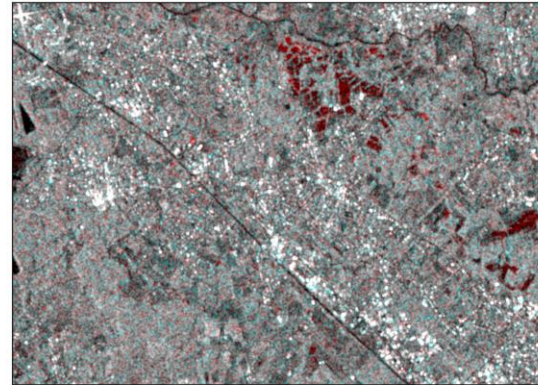
Use cases

CROP PHENOLOGY DETECTION WITH DATA FUSION OF SENTINEL 1 AND 2



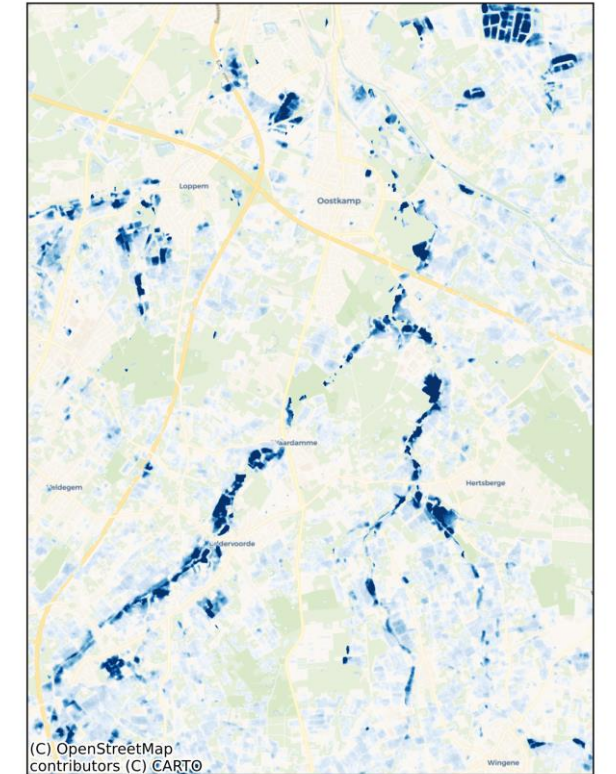
Use cases

FLOOD EVENTS BELGIUM, JULY 2021



(C) OpenStreetMap contributors
(C) CARTO

- | | |
|--------------------|-------------------------|
| Permanent Water | Flooded Vegetation |
| Open Flooding | Possibly Flooded Forest |
| Unsure Flooding | Invisible Forest |
| Long-term Flooding | |



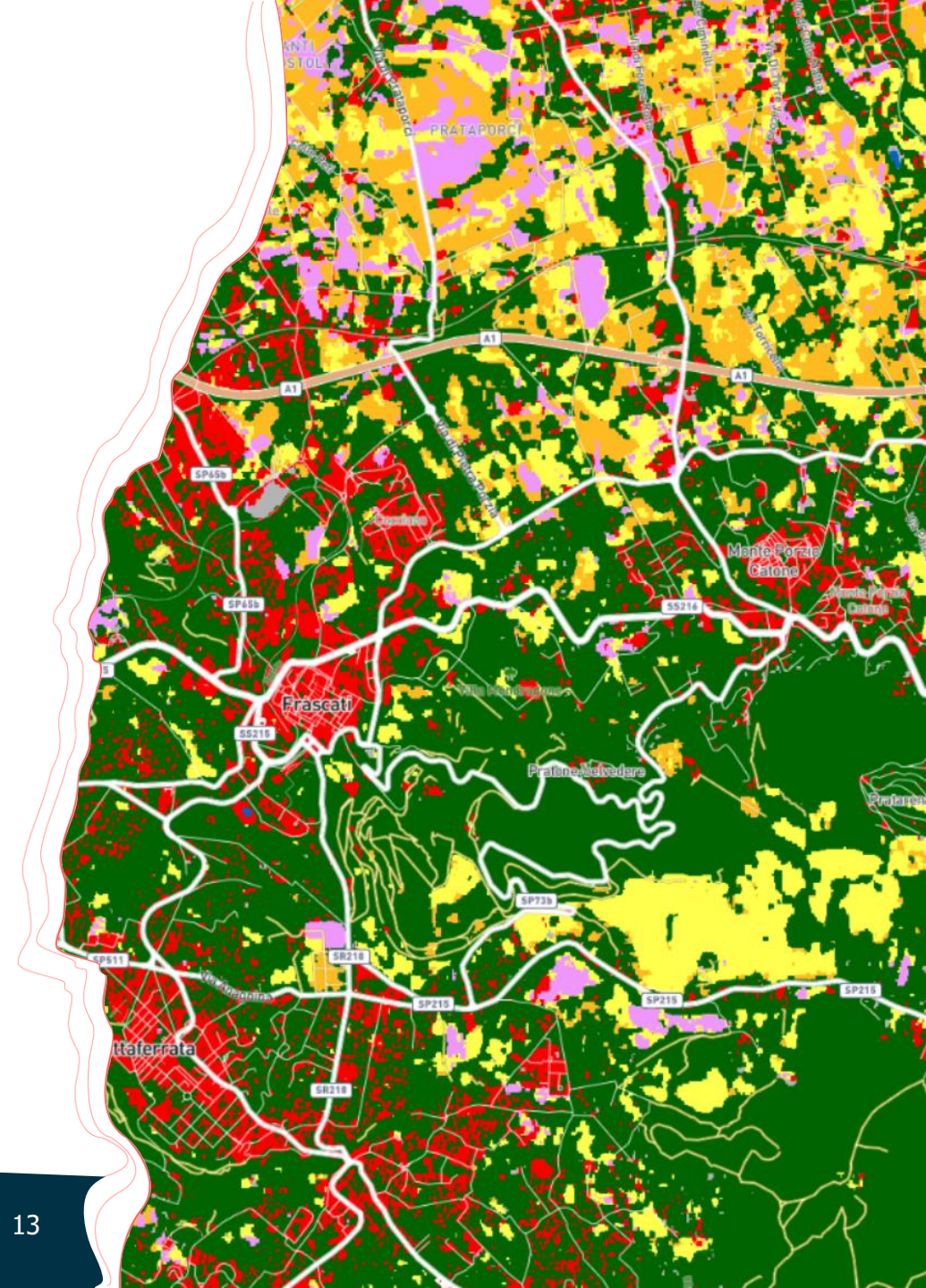
(C) OpenStreetMap contributors (C) CARTO

What the future holds

Addition of more datasets:

- Sentinel-3 SYN-VGT products
- Sentinel-5P HCHO and CH4 products
- ESA World Cover & World Cereal maps
- ML training data sets

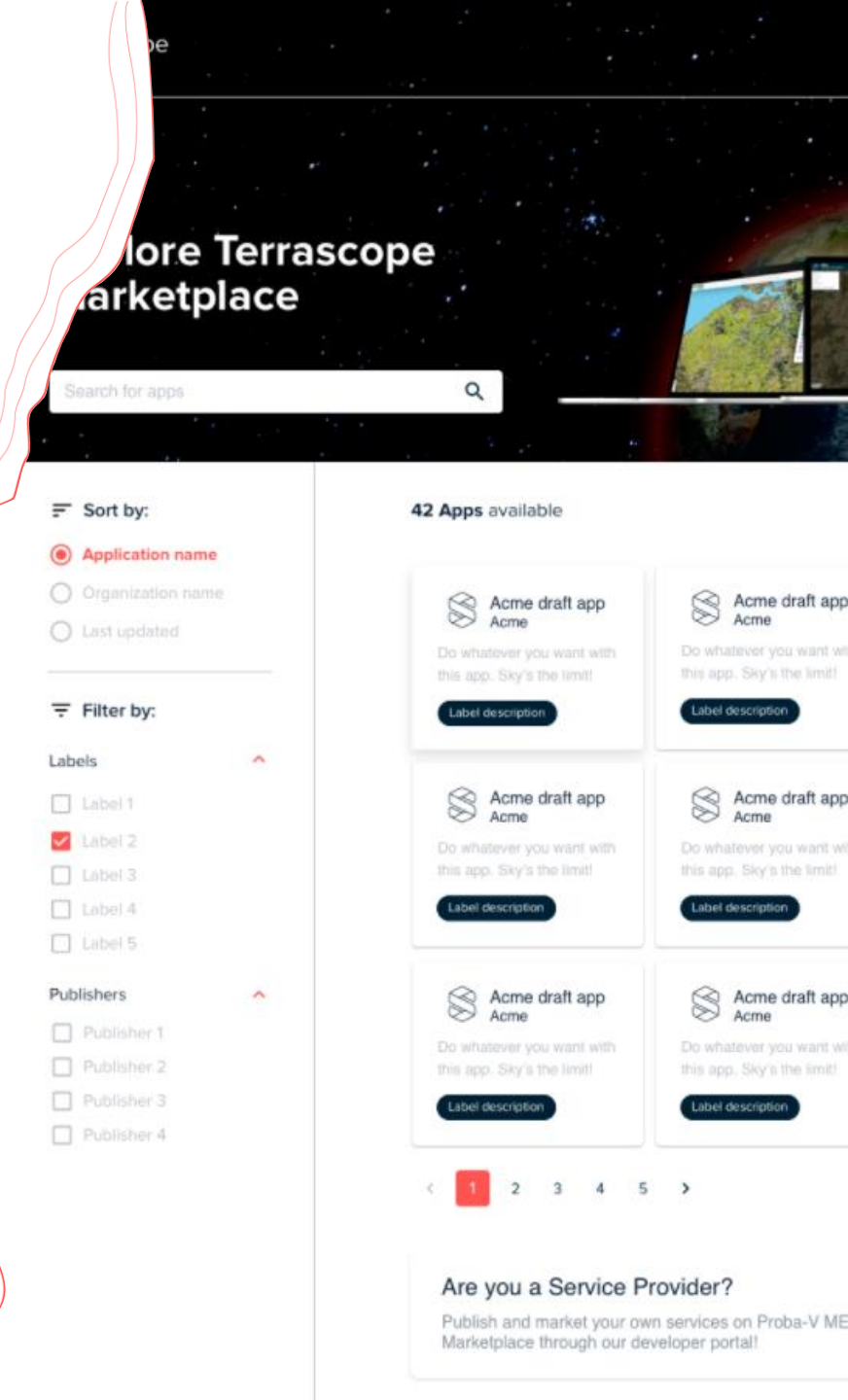
Extension to CreoDIAS back-end using OpenEO API



Terrascope Marketplace

TO BE RELEASED END OF OCTOBER 2021

- Algorithms-as-a-Service (AaaS)
- Provision of:
 - Marketplace platform on OpenEO or ASB Orchestrators
 - Storage & processing capacity
 - Sponsoring opportunities
 - Payment and remuneration policies
 - NoR exposure
- 3th party services to be onboarded and rewarded for the use of their algorithm/added value products





Thank You

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@Terrascope_BE

www.terrascope.be



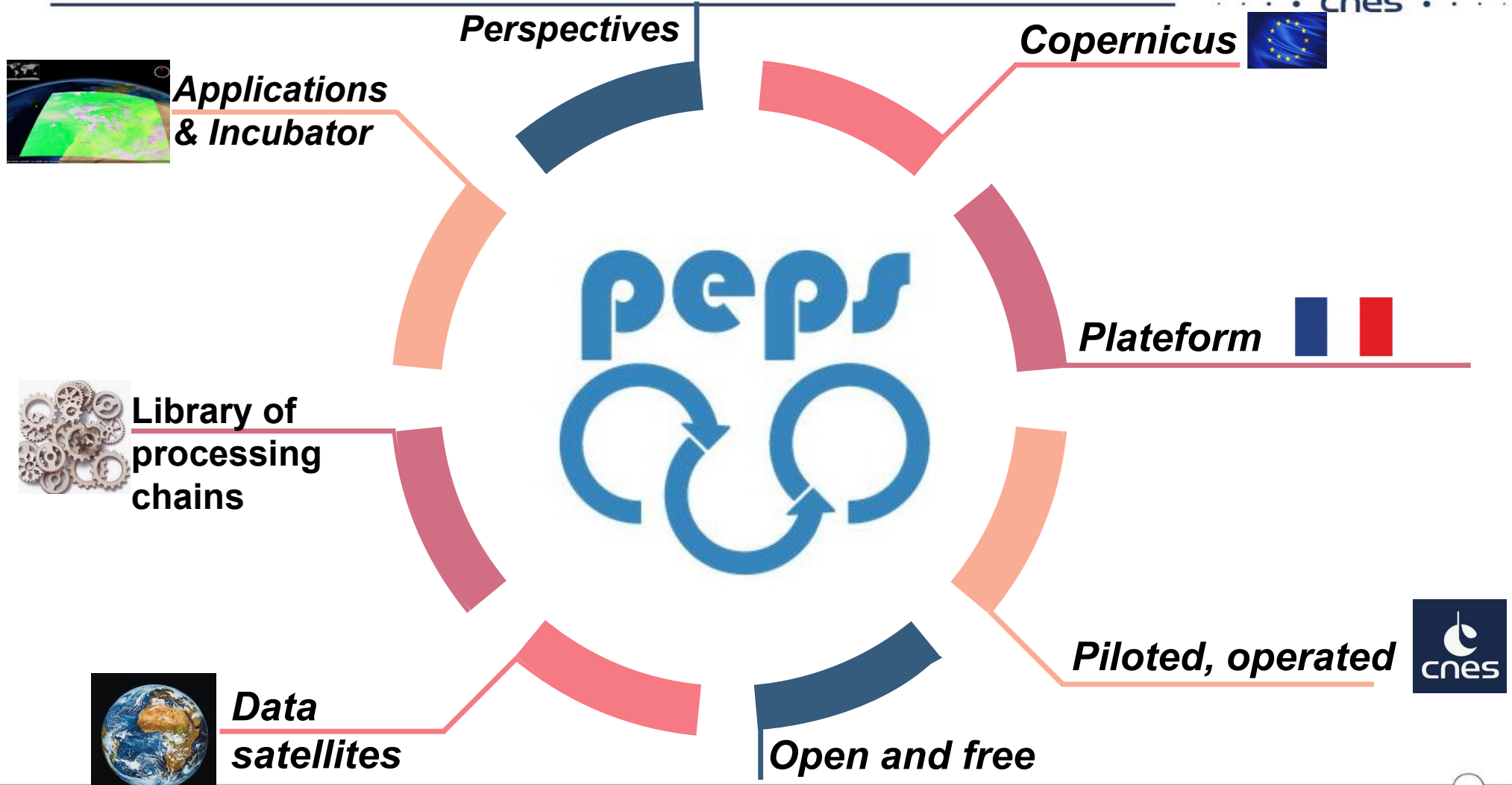
French Collaborative Ground Segment : PEPS

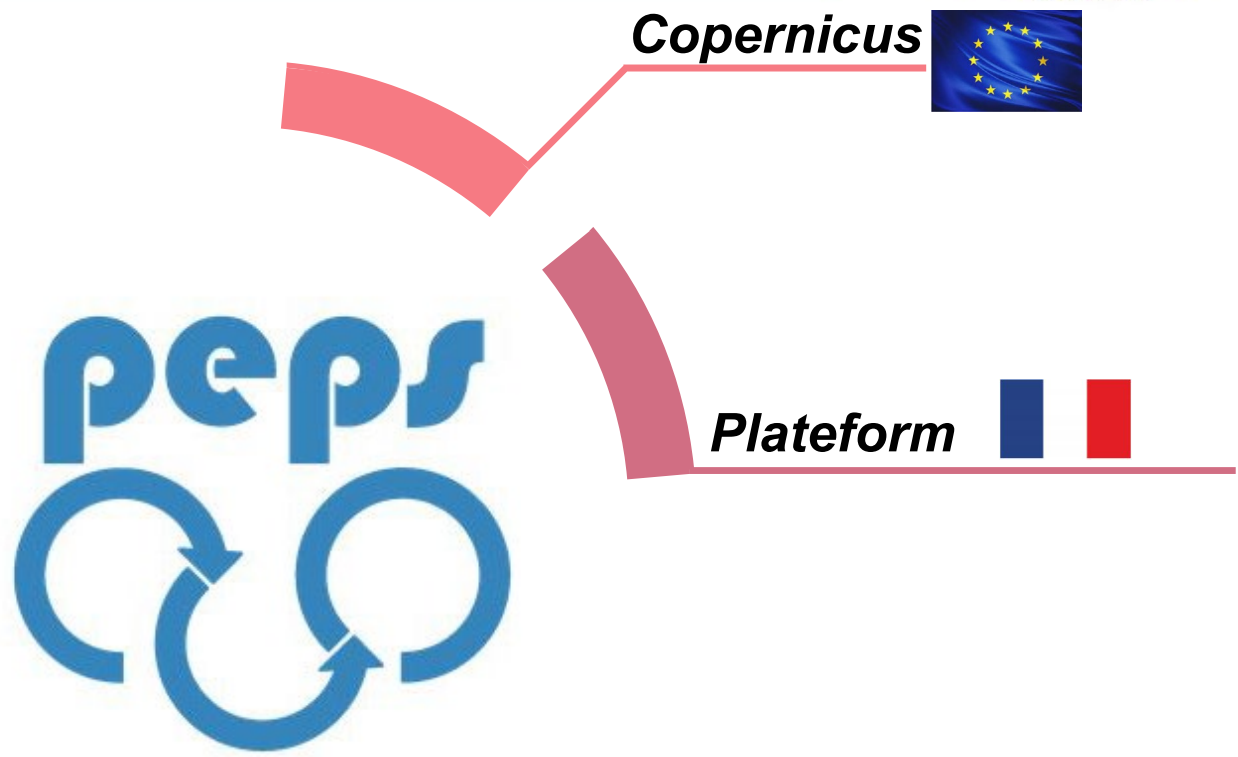
Open access to space data for scientific & business use

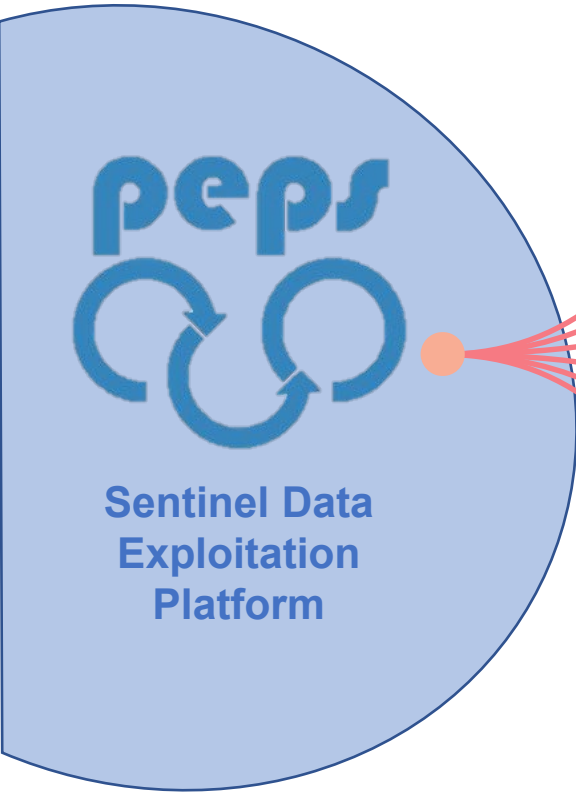
I. Soleilhavoup



The screenshot shows a web browser window displaying the Peps website. The browser's address bar shows the URL <https://peps.cnes.fr/rocket/#/home>. The website header includes the 'cnes peps' logo on the left and navigation links for 'ACCUEIL', 'EXPLORER', 'PEPS-RSS', and 'PLUS'. There are also two buttons: 'SE CONNECTER' and 'S'ENREGISTRER'. The main content area features the 'peps' logo, which consists of the word 'peps' in blue lowercase letters above a circular graphic of three interlocking arrows. Below the logo is the text 'PLATEFORME D'EXPLOITATION DES PRODUITS SENTINEL'. A large banner image shows a satellite map of a river system with orange highlights. The banner contains the text 'LE TRAITEMENT MAJA EST DISPONIBLE' and a paragraph: 'Vous pouvez dès à présent lancer le traitement MAJA sur les produits L1C de votre choix. La description complète est disponible dans votre centre de traitements.'







FRENCH initiative for access to Copernicus data

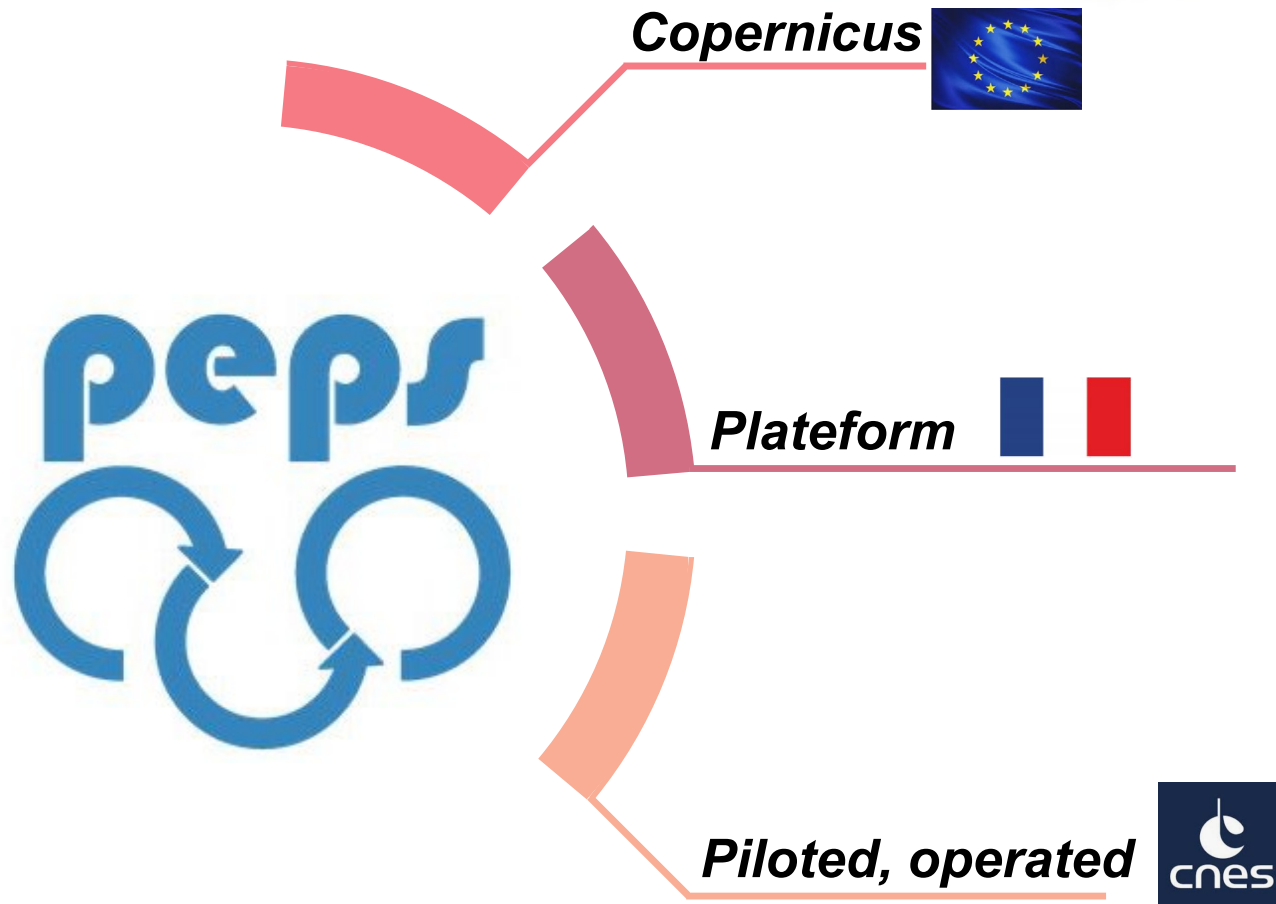
Platform for making available data from the **Sentinel 1** and **Sentinel 2** satellites.

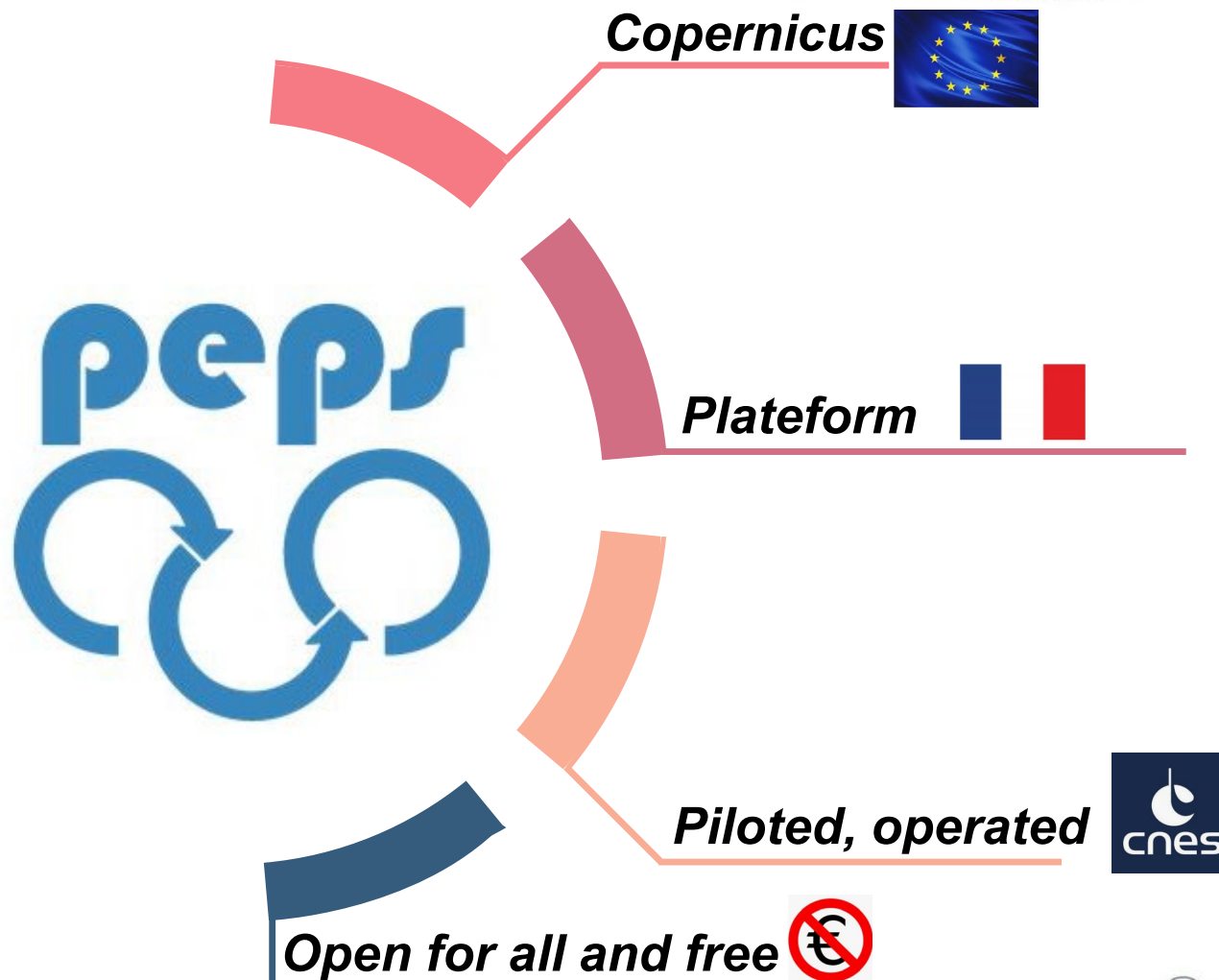
Satellite data **free** and **accessible to all**

Quick and global access to Sentinel products (and archive)

Possibility of applying various processing chains easily to these products with large computing resources.

Incubator for start-ups & labs





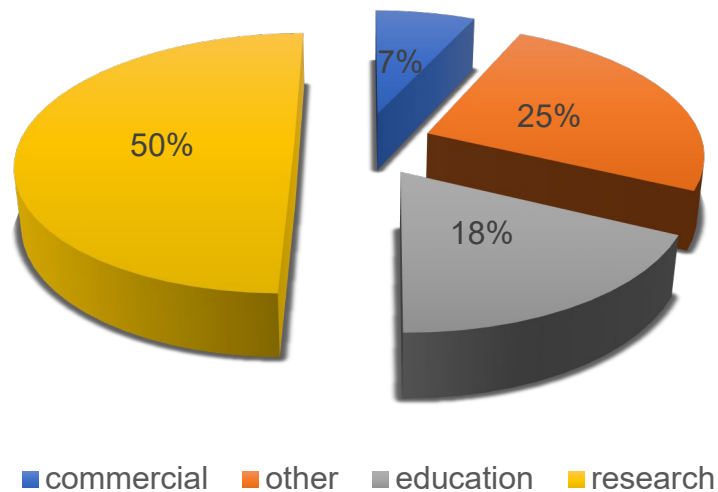
Location of the 8040 PEPS users

Countries with >35 PEPS users

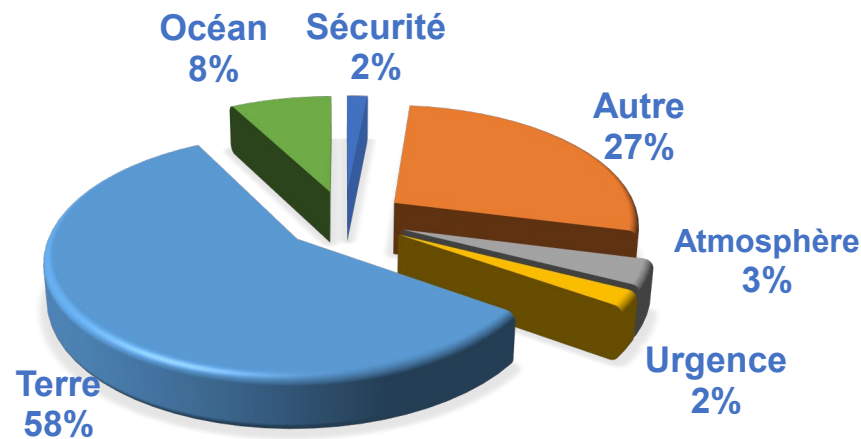


54% France
69% Europe
10% Africa
3% So. Am.
2% China
2% USA

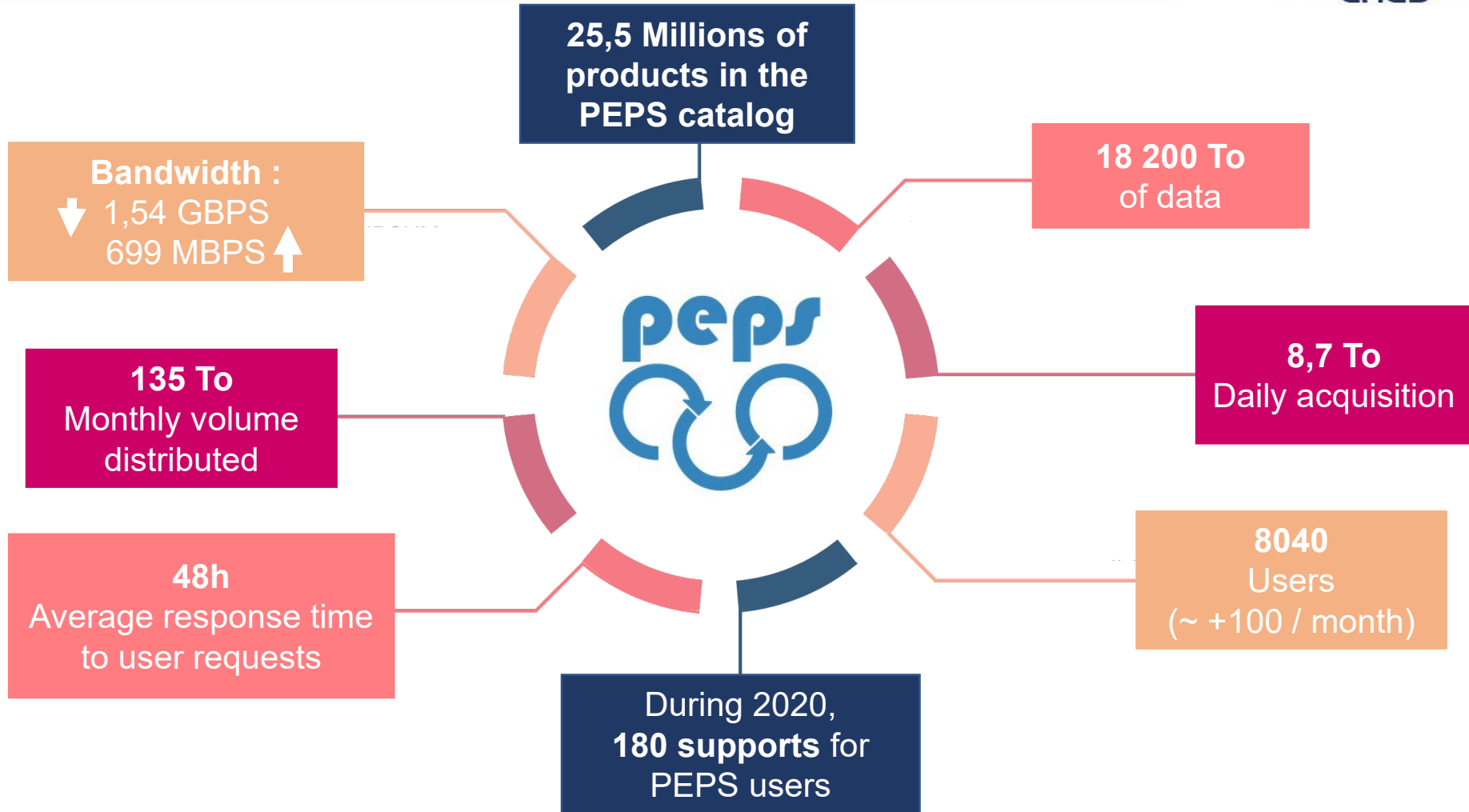
Domain



THEME

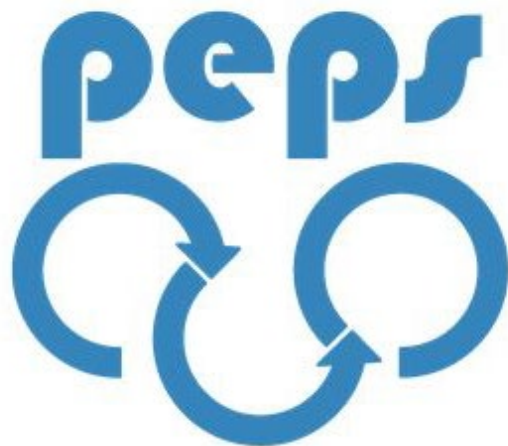


PEPS in a nutshell (figures taken from September 2021)





**Satellite
Data**



Copernicus



Plateforme

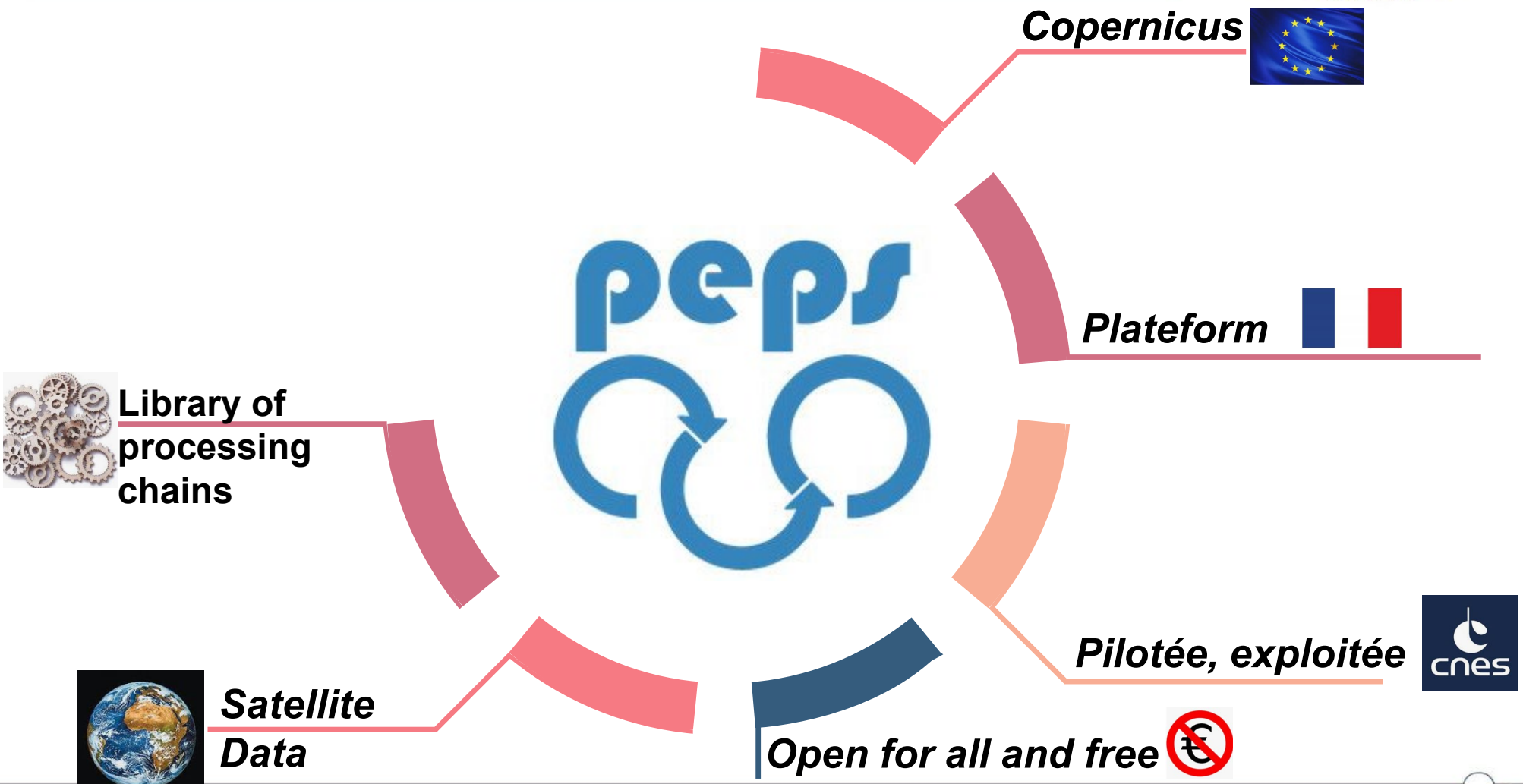


Piloted, operated



Open for all and free





Processing available on the PEPS platform

Calculation of radiometric index NDVI

Ortho-rectification and tiling of Sentinel-1 GRD products on the Sentinel-2 grid (MGRS)

Metadata extraction

Calculation of radiometric index LAI

MEDICIS (S2 images correlation)

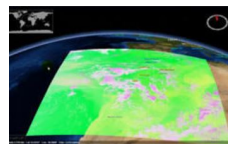
Atmospheric correction of a S2 product (MAJA)

4 color composition treatments

Polarization extraction

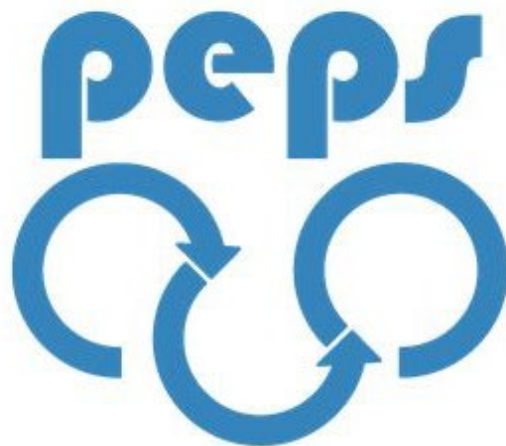
Atmospheric correction of a series of S2 images (full-MAJA)





Incubator

Copernicus



Plateform



**Treatments
library**



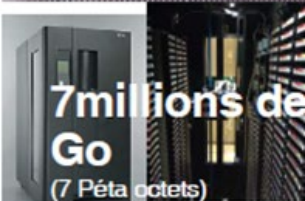
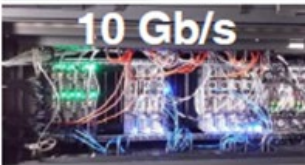
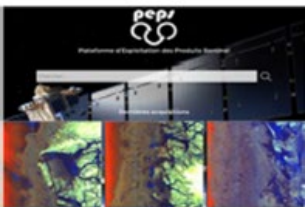
Piloted, operated



**Satellite
Data**



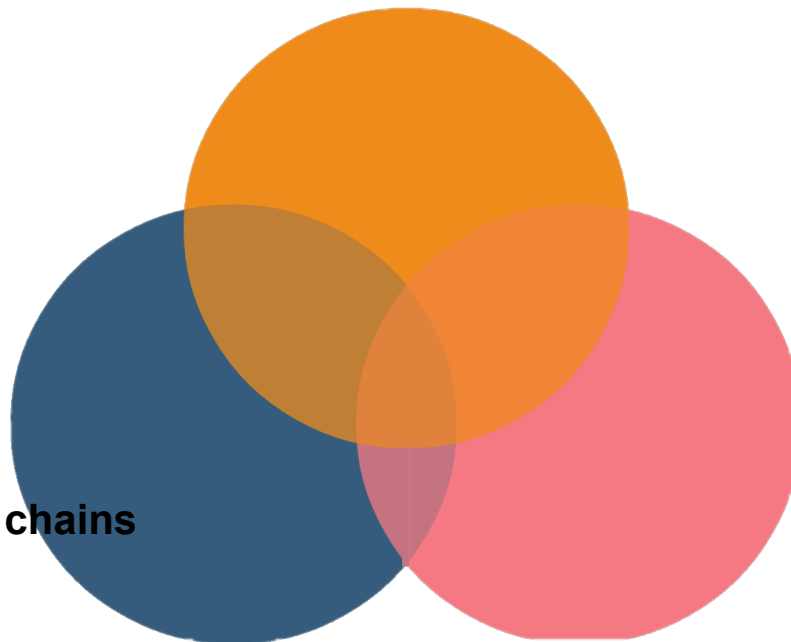
Open for all and free 

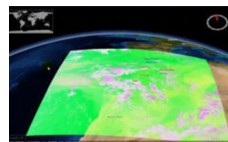


Computing power

Library of
processing chains

Proximity to satellite data

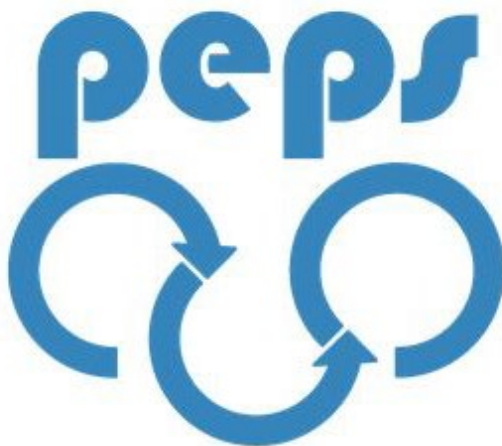




**Applications
& Incubator**

Perspectives

Copernicus



Platform



**Treatments
library**



Piloted, operated



**Satellite
Data**



Open for all and free 

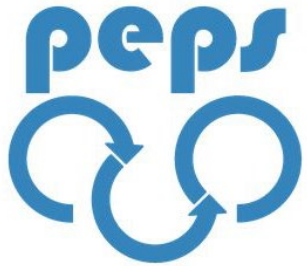
New PEPS architecture in 2021 (cluster of dematerialized servers)

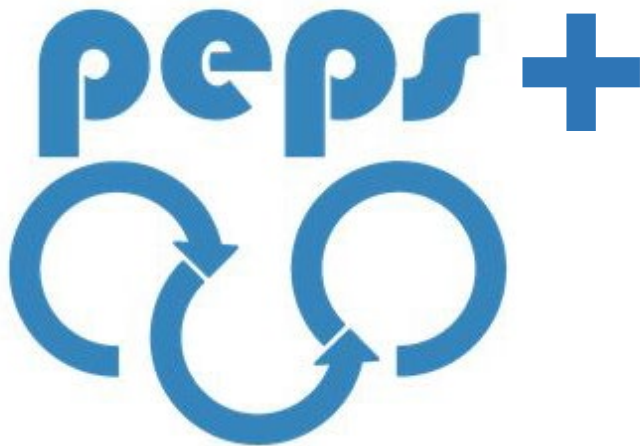
VRE for PEPS users available since Jan. 2021

PEPS : Pilot project for the migration to the Datalake (S1 2022)

Arrival of new scientific processing chains

PEPS community support



GeoDataHub =  +

Data Terra Research Infrastructure Structuration and Organisation in 2021

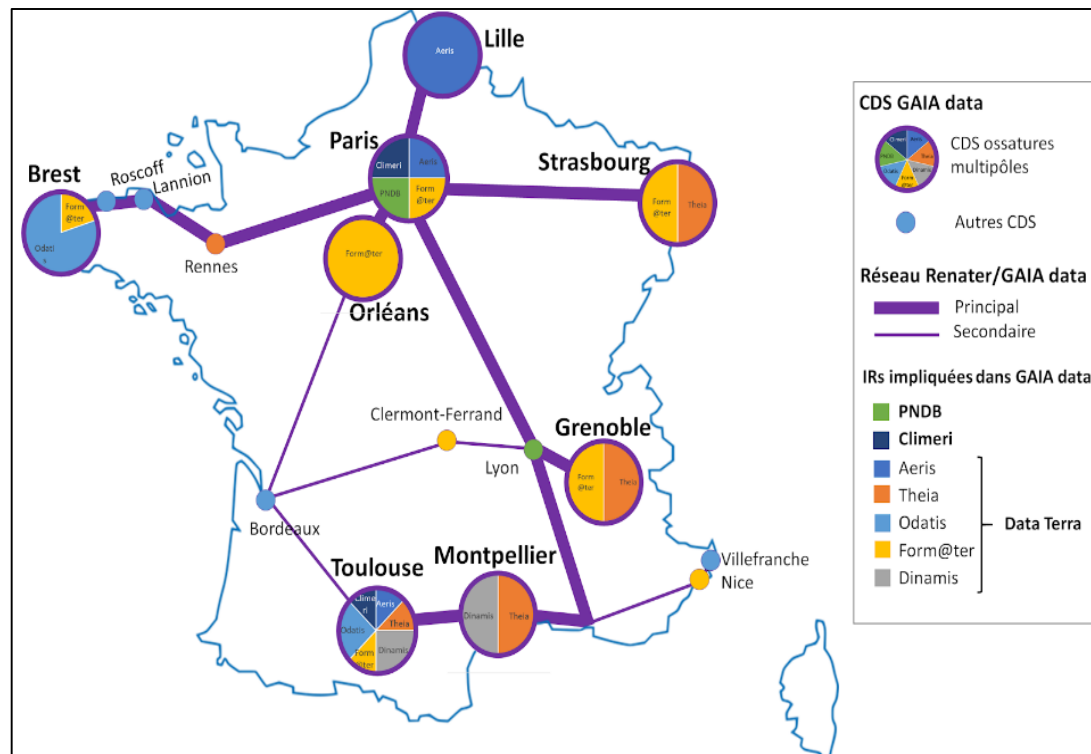
More than 20 years of continuous investments

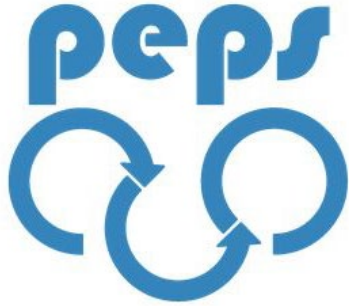
4 Data & Service Hubs

- **AERIS** - atmosphere
- **Form@ter** – solid Earth
- **ODATIS** - Ocean
- **THEIA** – Land surfaces

Cross-cutting devices

- **DINAMIS** : access to HR & VHR images
- **Technical committee**
- **Science WG**
- **Europe & International WG**





- Sentinel-1
- Sentinel-2

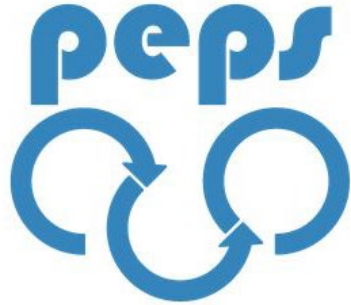


... from 2023 ... (codename : « GeoDataHub »)

- Sentinel-1
- Sentinel-2
- SPOT world Heritage data (SPOT1-5 30 year Archive)
- Thematic data centre value-added products



- Data from all EO missions operated by CNES



- Ortho & Tiling
- Atmospheric correction
- Radiometric indices (e.g. LAI, NDVI)
- Image correlation



... from 2023 ... (codename : « GeoDataHub »)

- Ortho & Tiling
 - Atmospheric correction
 - Radiometric indices (e.g. LAI, NDVI)
 - Image correlation
- &
- Virtual Research Environment (VRE)
 - Nocode
 - Datacube?

- **CNES would like to extend access to SPOT World Heritage data**
 - 19 million SPOT scenes acquired between 1986 and 2015
 - Possibility for other CollGS platforms to propose a connection to this archive to their communities?
 - Discovery : Opensearch, STAC
 - Access : Authentication needed - Federation of identities between CollGSs?

- **Test Dataset Sentinel2 (Via CollHUB)**

Austria



**Alexander Jann
Matthias Langer
Stefan Buchberger**



Christian Briese



Thomas Geist

Austrian Collaborative Ground Segment

- ✓ Data Access, Enabling Services, (R&D) Projects
- ✓ Important Element for Copernicus User Uptake in Austria so far ...
- ✓ ... and one Cornerstone for the Implementation of the Austrian Space Strategy 2030+

The Austrian Space Strategy 2030+ pursues the following six goals:

1. Sustainable development on Earth and in space.
2. Competitive space sector with high added value and sustainable jobs in Austria
3. Scientific excellence for space and Earth exploration
4. Space for all areas of life
5. Talent and diversity for space
6. Space dialogue with the population



ZAMG - Sentinel Services

Stefan Buchberger



ZAMG
Zentralanstalt für
Meteorologie und
Geodynamik



Start of the DHR Operation: Late 2016 Services:

- Data Hub Relay: `vsentdhr.zamg.ac.at`
- National Mirror: `data.sentinel.zamg.ac.at`



Products

- Sentinel S1, S2, S3 (Global)
- Sliding window of 15 Days
- 20 Million products
- 1,1 Petabyte Archive
- National Mirror: 110 TB served to 1841 Users



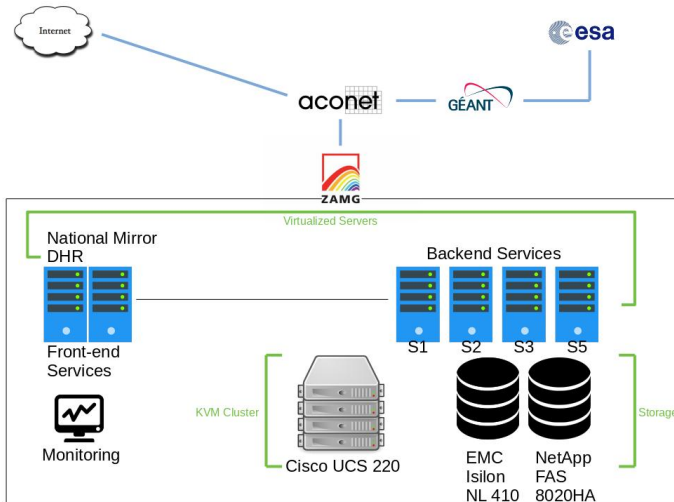
- KPI Implementation
- Debian 10, DHuS 2.0.0 and PostgreSQL
- Ansible-Role for the automatic installation of the DHuS Software
- Migration of our Monitoring System to Zabbix
- Firewall/Loadbalancer Migration
- Switch Migration



- Debian 11
- Upgrade to the Latest DHuS version (3.0.0)
- Rewriting of some old scripts

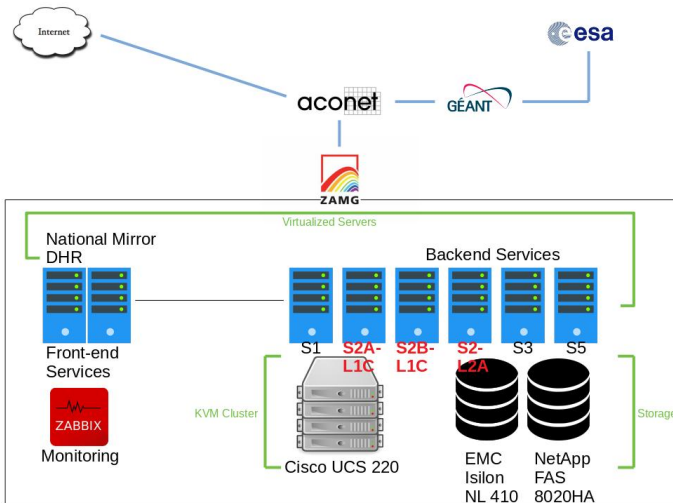
Old Infrastructure

IAT^EX
15. Oktober 2021
Folie 6/8



Updated Infrastructure

IAT^EX
15. Oktober 2021
Folie 7/8



Thank you for your Attention !

`zamg-dhr@zamg.ac.at`

`stefan.buchberger@zamg.ac.at`

`matthias.langer@zamg.ac.at`

EODC :: Services based on Sentinel Data

Christian Briese & the EODC Team

christian.briese@eodc.eu

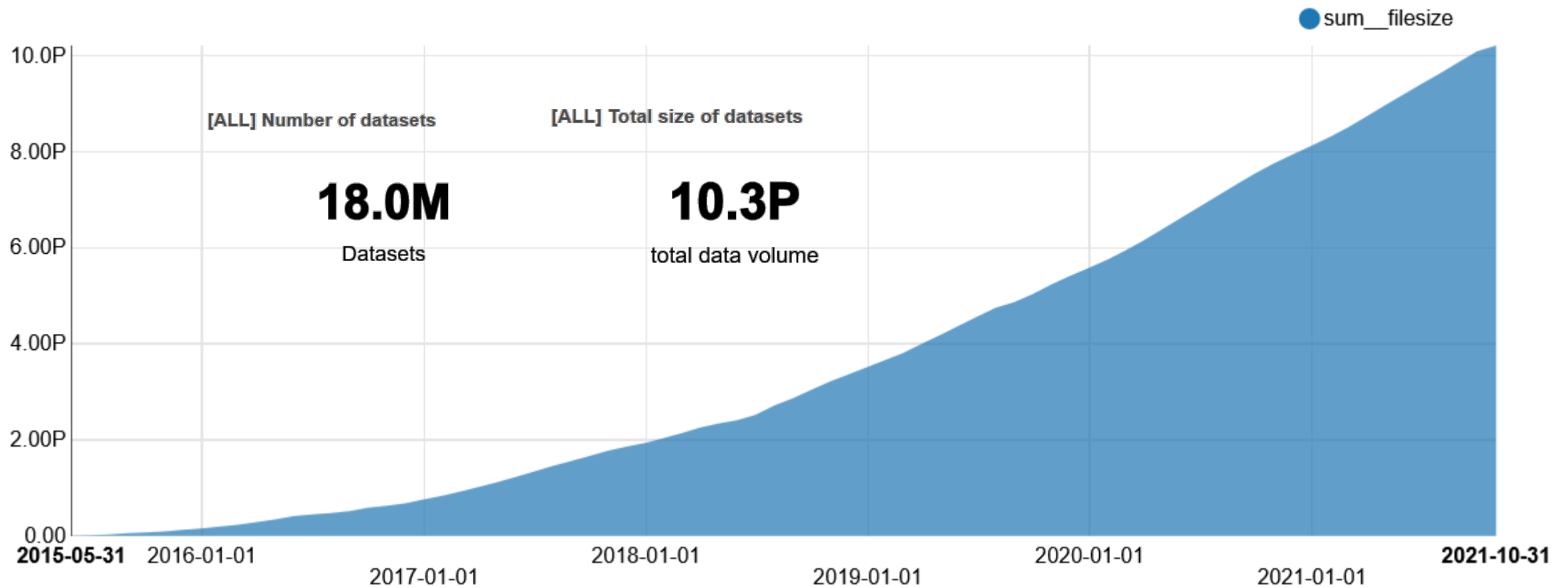


EODC offers



EO Sentinel Data Archive (Status 17.10.2021)

[All] Cumulative Sum (combined)



Services via ESA contracts

- openEO platform



<https://openeo.cloud>



- Data Hub Relay: ESA Missions

**ESA EO Missions
Data Hub Relay**

Data Hub Relay operated by EODC

Access



<https://datahub.eodc.eu/>

ESA EO Missions Data Hub Relay operated by EODC

<https://datahub.eodc.eu/>

<https://dhr.datahub.eodc.eu/>



ESA Earth Explorer Mission and ESA Missions

Observing the Earth

ADM-Aeolus



Dedicated to measure wind profiles

[Read More](#)

CryoSat



Observing sea-ice and ice sheets from space

[Read More](#)

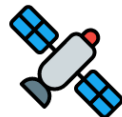
Envisat



Continuous observation of the Earth

[Read More](#)

ERS



Continuous observation of the Earth

[Read More](#)



EODC - ESA EO Missions Data Hub Relay

Insert search criteria...

Display 2476 to 2500 of 71539 products.

0 products selected

Order By: Ingestion Date ↓

Request Done: ((platformname:Aeolus) OR (platformname:Envisat AND producttype:MER_FRS_2P))

ENV MERIS ENV_ME_2_FRG 20090314T011115 20090314T011931 0495_077_160
Download URL: [https://dhr.datahub.eodc.eu/odata/v1/Products\('4cc12be2-8157-443a-9b05-66415c4a223e'\)/\\$value](https://dhr.datahub.eodc.eu/odata/v1/Products('4cc12be2-8157-443a-9b05-66415c4a223e')/$value)
Mission: Envisat Instrument: MERIS Sensing Date: 2009-03-14T01:11:15.762216Z Size: 1.54 GB

ENV MERIS ENV_ME_2_FRG 20090314T074517 20090314T075417 0540_077_164
Download URL: [https://dhr.datahub.eodc.eu/odata/v1/Products\('63e4c82b-58bb-440f-937c-f08b3b3d7eb0'\)/\\$value](https://dhr.datahub.eodc.eu/odata/v1/Products('63e4c82b-58bb-440f-937c-f08b3b3d7eb0')/$value)
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AE ALADIN AE_OPER_ALD_U_N_2B_20210901T085120_20210901T102132_0001
NO QUICKLOOK
Download URL: [https://dhr.datahub.eodc.eu/odata/v1/Products\('c541fccd-c4f9-4d25-922d-9980d7babc54'\)/\\$value](https://dhr.datahub.eodc.eu/odata/v1/Products('c541fccd-c4f9-4d25-922d-9980d7babc54')/$value)
Mission: Aeolus Instrument: ALADIN Sensing Date: 2021-09-01T08:51:20.000Z Size: 17.6 MB

ENV MERIS ENV_ME_2_FRG 20090314T092555 20090314T093441 0526_077_165
Download URL: [https://dhr.datahub.eodc.eu/odata/v1/Products\('52f57171-a967-405e-9208-bdc4317b27da'\)/\\$value](https://dhr.datahub.eodc.eu/odata/v1/Products('52f57171-a967-405e-9208-bdc4317b27da')/$value)
Mission: Envisat Instrument: MERIS Sensing Date: 2009-03-14T09:25:55.183772Z Size: 1.79 GB

Available Data Collections

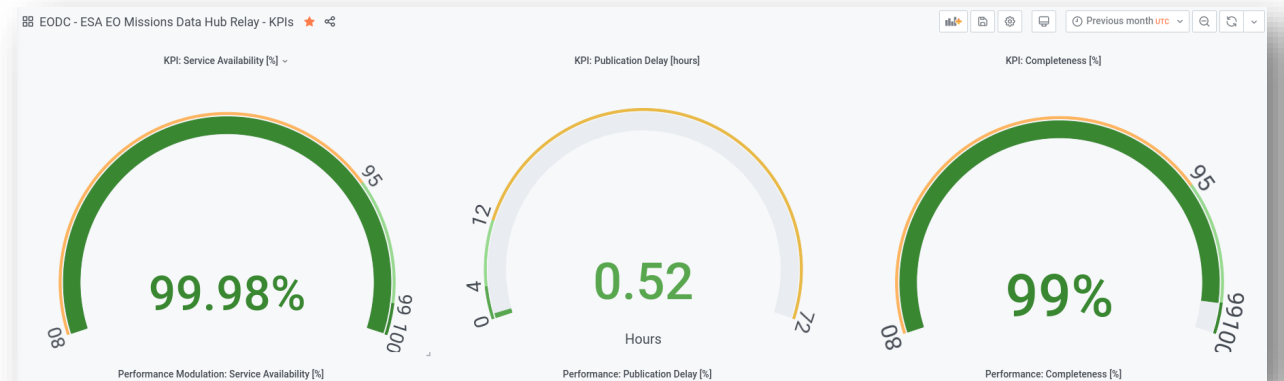
- Aeolus
 - L1B preliminary products
 - L2B scientific wind products
- CryoSat
 - L2 ice and ocean products
- Envisat
 - L2 AATSR Land Surface Temperature (LST) product
 - L1 ASAR images
 - L2 MERIS products
 - L2 Radar Altimeter products
- ERS
 - L2 ATSR Averaged Surface Temperature products
 - L1 ATSR gridded brightness temperature/reflectance products
 - L2 Radar Altimeter products
 - L2 Scatterometer products



More details on **datahub.eodc.eu**

Service Performance & Statistics

- The DHR aims to provide a
 - highly available service,
 - fast product delivery and a
 - complete catalogue.



Live mission data,
September 2021

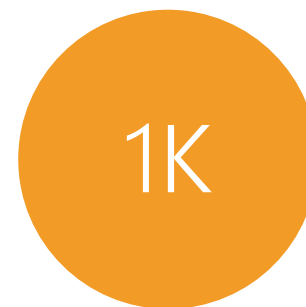
- Data Statistics



Number of Products



Total Data Volume

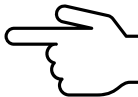


New Products per Day



Historic Data To Come

System & User Details

- The DHR is set up on the EODC Cloud environment (OpenStack)
 - Isolated project with dedicated resources
 - VM-based service deployment
- Developed Software Packages to support EO Mission Data
 - DHuS Addons (Metadata Extractor)
 - Available from EODC's GitHub at <https://github.com/eodcgmbh>
- User Registration
 - No self-registration, registration available to Collaborative Ground Segments
 - Contact us at support@eodc.eu 

New: Global Sentinel-1 Data Cube (2015-2021)

Sentinel-1 ARD datacube: Concept of **Equi7Grid data structure** & **time series access** | Example for T3-tile over the USA

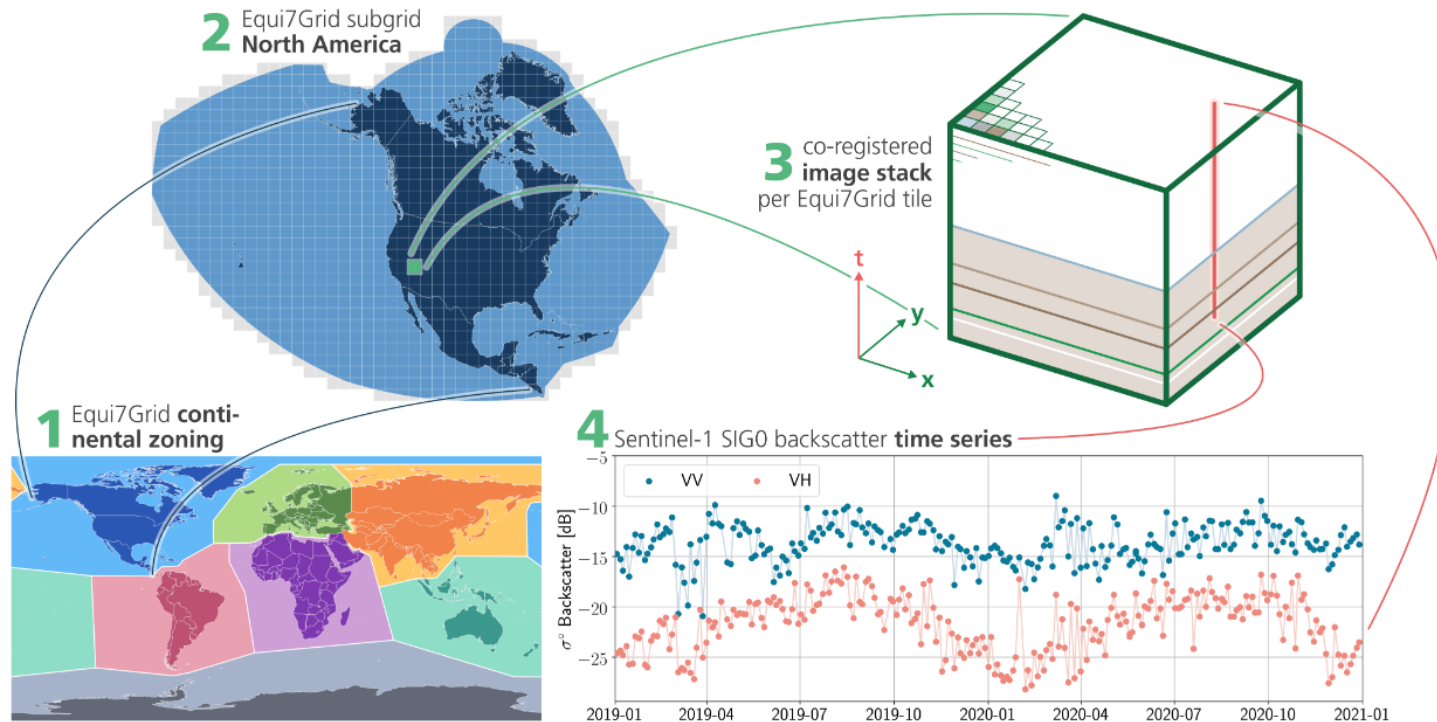


Figure 3. Illustration of the Equi7Grid, its continental zoning, its tiling, and the resulting data structure. Each layer of the individual image stacks corresponds to one Sentinel-1 acquisition with a unique time stamp. Sentinel-1 IW scenes are generally split into multiple tiles (20 m-sampled data into 300 km-tiles [T3], 10 m-sampled data into 100 km-tiles [T1]), and the corresponding tiles are filled up with no-data values where the satellite image has no overlap.

Sigma 0

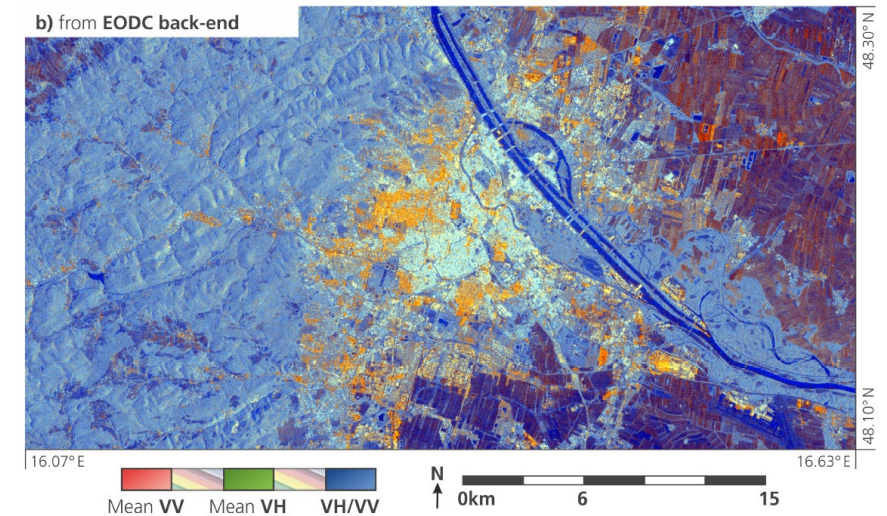


Figure 6. Sentinel-1 VH/VV-polarisation RGB composite (R=daily mean of VV, G=daily mean of VH, and B=VH/VV), showing Vienna on 2nd March 2017, created via openEO, at GEE (top), and at EODC back-end (bottom).



Federation activities

- WEkEO via harmonised data access



- EOSC: H2020 Copernicus - eoSC AnaLytics Engine (C-SCALE) project

- C-SCALE services in EOSC
 - C-SCALE EO Data Archive
 - C-SCALE Compute services
 - C-SCALE EO Analytics platforms



C-SCALE



**EUROPEAN OPEN
SCIENCE CLOUD**

info@c-scale.eu | <http://c-scale.eu/>



Deltares



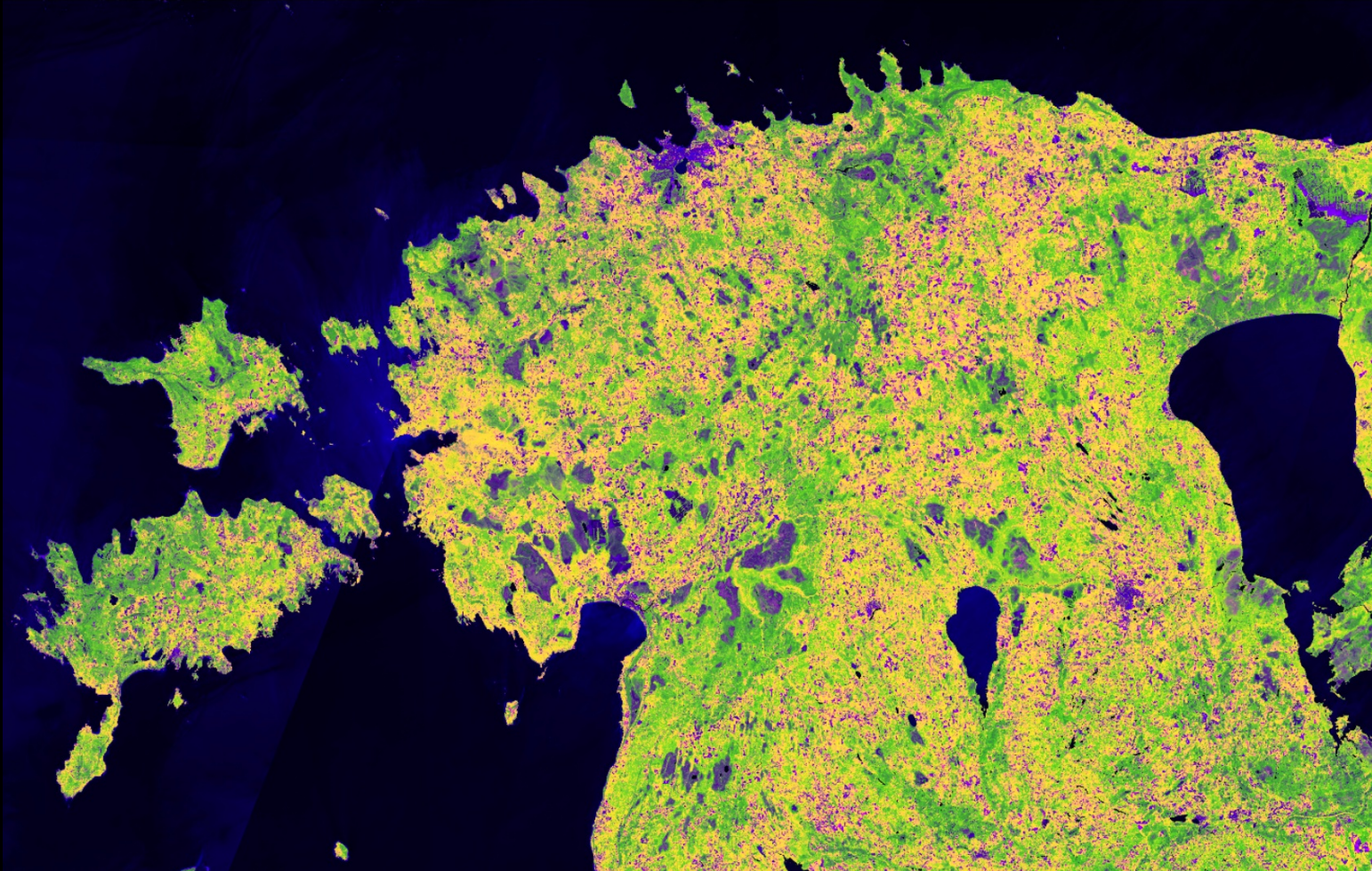
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017529.

Thank you for your attention !

The ESTHub way



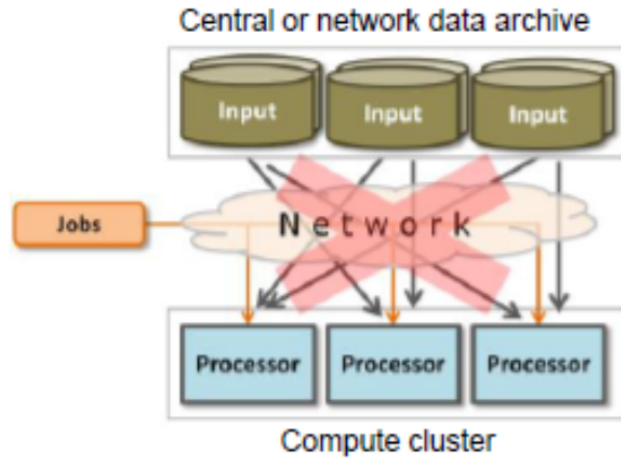
MAA-AMET 30 



16th of May 2019 – launch of the ESTHub

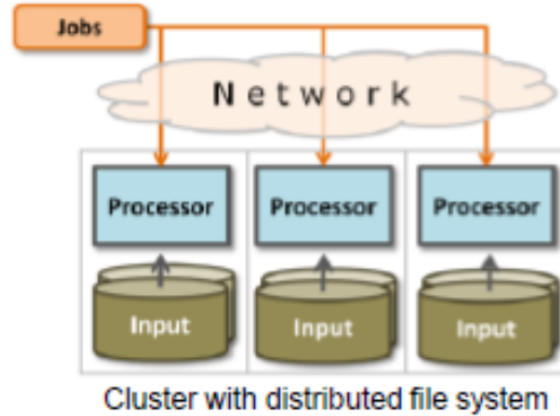


Inside the ESTHub



Archive-centric approach

- ▶ Network storage
- ▶ data are transferred over the network
- ▶ risk of network bottleneck



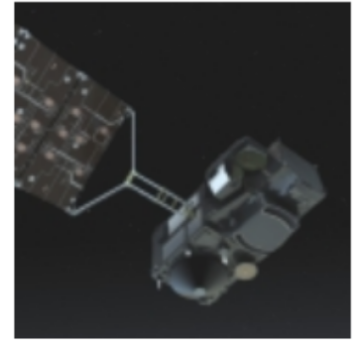
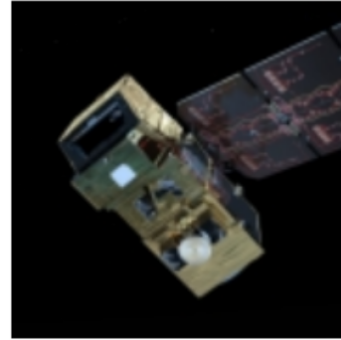
Hadoop approach

- ▶ concurrent data-local processing
- ▶ tasks are transferred over the network
- ▶ good scalability



Data choice of the [ESTHub](#) 2019

- Sentinel-1
- Sentinel-2
- Sentinel-3



ESTHub data portal and the AOI for ingestion

The screenshot displays the ESTHub satellite data portal interface. At the top, the header includes the Republic of Estonia Land Board logo and the text "ESTHub satellite data portal". Below the header is a search bar with the placeholder text "Insert search criteria...".

The main content area is divided into two sections. On the left, a list of products is displayed, showing 1 to 25 of 56 products. The products are ordered by ingestion date. The first product is S2A_MSI_S2A_MSIL1C_20200817T094041_N0209_R036_T34VFH_20200817T1... with a download URL and mission details. The second product is S2A_MSI_S2A_MSIL1C_20200817T094041_N0209_R036_T34UFG_20200817T1... with a download URL and mission details. The third product is S2A_MSI_S2A_MSIL1C_20200817T094041_N0209_R036_T35VNF_20200817T1... with a download URL and mission details. The fourth product is S2A_MSI_S2A_MSIL1C_20200817T094041_N0209_R036_T35VLD_20200817T1... with a download URL and mission details. The fifth product is S2A_MSI_S2A_MSIL1C_20200817T094041_N0209_R036_T35ULB_20200817T1... with a download URL and mission details. The sixth product is S2A_MSI_S2A_MSIL1C_20200817T094041_N0209_R036_T35UMB_20200817T1... with a download URL and mission details.

On the right, a map shows the geographical area of interest (AOI) for ingestion. The AOI is defined by a green polygon that covers parts of Estonia, Latvia, and Lithuania. The map includes labels for various cities and regions, such as Tallinn, Tartu, Riga, and Vilnius. The map also shows the Baltic Sea and the Gulf of Riga.

At the bottom of the interface, there is a pagination control showing "Products per page: 25" and "page: 1 of 3". There is also a "Graticule" checkbox and a "DD" button. The bottom status bar shows the coordinates "Lat Lon: 53.18, 28.45".

ESTHub web processing service – Calvalus GUI



REPUBLIC OF ESTONIA
LAND BOARD

Processing Service

▼ Order

L2 Processing

Match-up Analysis

Regional Statistics

L3 Processing

▼ Management

Regions

Requests

Productions

▶ Links

Input File Set

- Show predefined file sets
 Show my outputs and of other users

| |
|-----------------------------|
| Sentinel-2 MSI L1C |
| Sentinel-2 MSI L2 |
| Landsat 8 OLI and TIRS L1 |
| Sentinel-1 SLC |
| Sentinel-1 GRD |
| Sentinel-1 OCN |
| Sentinel 3 OLCI EFR Level 1 |
| Sentinel 3 OLCI LFR |

Show Help

Name: **Sentinel-2 MSI L1C**
Type: **S2_MSI_L1C**
Start Date: **2015-07-01**
End Date: **2020-12-31**
Region name: **Estonia**
Geo Inventory: **Yes**

Grassland mowing detection system

Estonian grassland mowing detection system SATIKAS (*the beetle*) uses remote sensing and meteorological data to determine the mowing dates for grassland parcels. Results are reported to farmers and inspectors via SMS reminders and web map service.



Web map showing results of mowing detection

Motivation and economic impact

Grasslands are among the most common land cover types in Europe. Mowing and grazing of grasslands as a requirement of the Common Agricultural Policy (CAP) for paying subsidies is often violated. Even though the number of violations is small the total loss due to wrongly directed subsidies at European level is large – exceeding 100M€/year. *In situ* checks covering whole country are not feasible. SATIKAS information system allows the inspectors' time be used more efficiently by initiating checks for unmown fields.

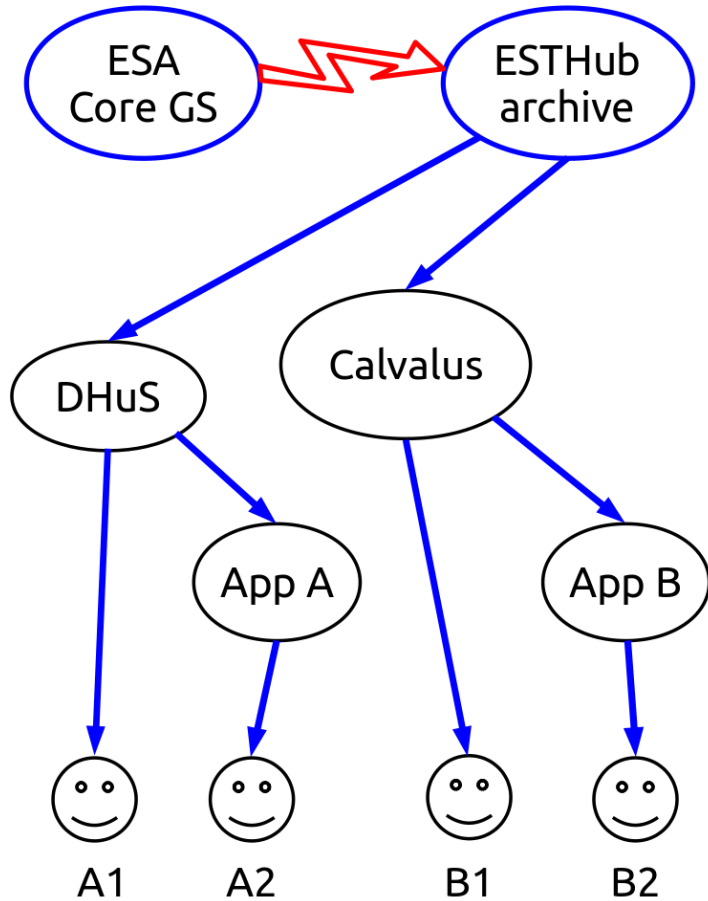
KappaZeta

KappaZeta is an SME focusing on the development of EO applications and services for the agricultural domain. Our mission is to develop innovative remote sensing applications and to integrate them into IT services with high economic impact to our customer. Our vision is to become a leading service provider in the field of satellite based grassland subsidy checks in Europe.

KappaZeta was founded in 2015 as **Tartu Observatory** spin-off. Our core expertise lies in the synthetic aperture radar (SAR) remote sensing. Understanding the underlying physics principles has always been our approach when developing practical applications. While the company itself is young, its personnel has profound experience in EO, GIS and IT systems development.

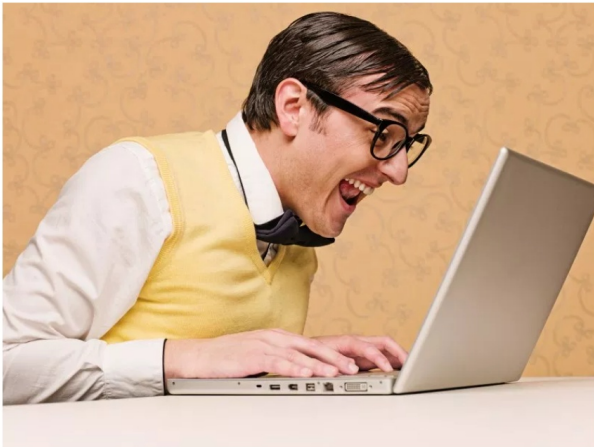


ESTHub business architecture 2019



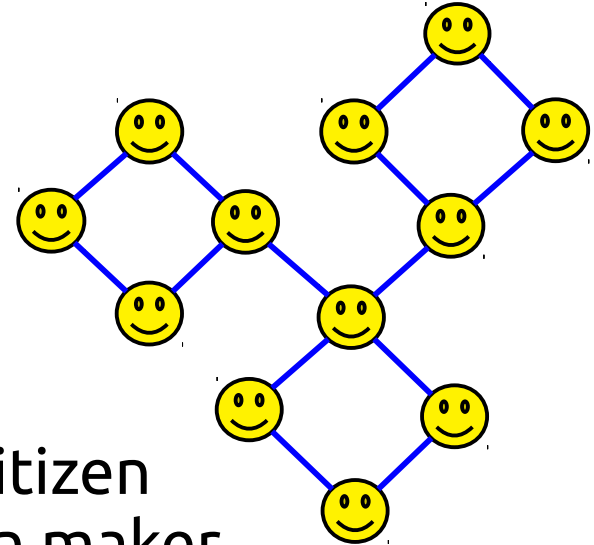
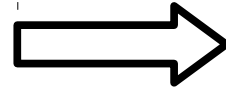
Shift of the strategy

ESTHub 2019



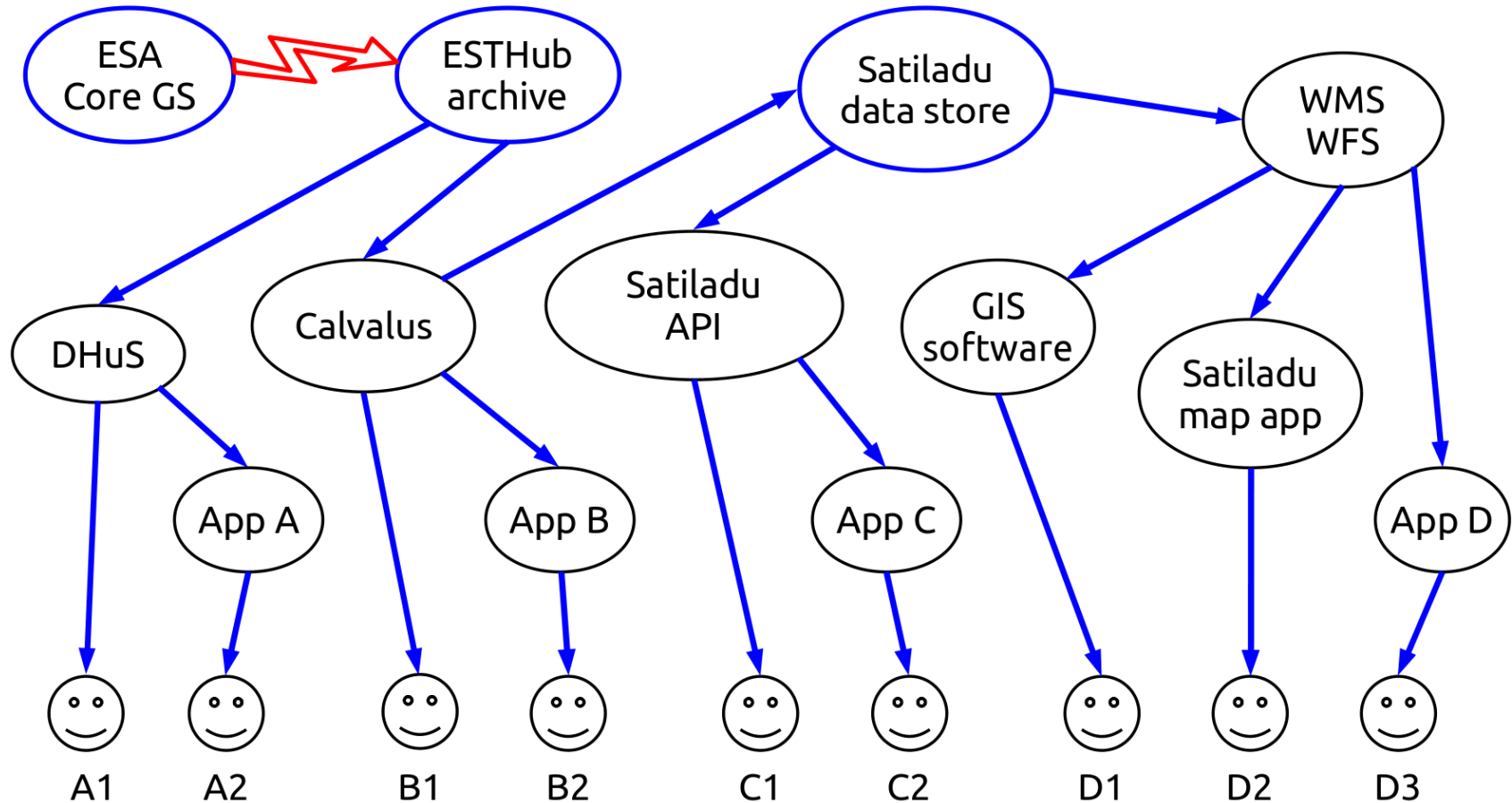
For EO scientist

ESTHub 2020+



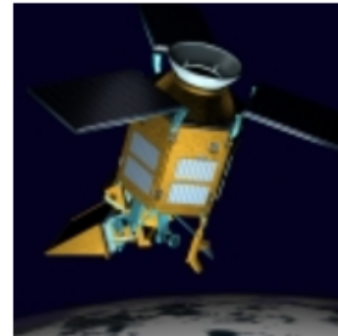
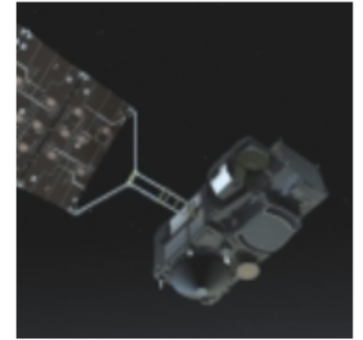
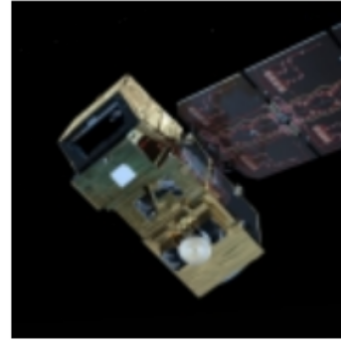
For every citizen
For decision maker
For the scientist

ESTHub business architecture 2020+



Data choice of the ESTHub 2022

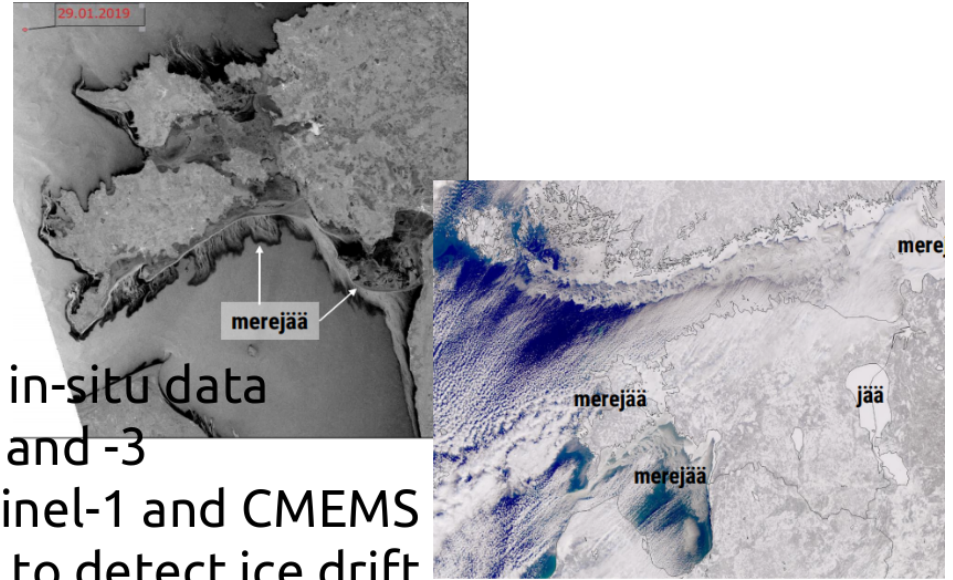
- Sentinel-1
- Sentinel-2
- Sentinel-3
- Sentinel-5P (WiP)
- Sentinel-6 (WiP)



Project „Ice mapping using Earth observation methods“ on ESTHub

- Following products are developed for operational use on ESTHub (already operational and automatically generated or will be ready in the nearest future):

- Pre-processed Sentinel-1 imagery
- Pre-processed Sentinel-3 imagery
- Ice segmentation from Sentinel-1
- Ice classification map from Sentinel-1
- Ice feature detection from Sentinel-1
- Ice thickness map from Sentinel-1 and in-situ data
- Lake ice cover map from Sentinel-1, -2 and -3
- Ice concentration detection from Sentinel-1 and CMEMS
- Coherence estimation from Sentinel-1 to detect ice drift



- Some of the above described algorithms involve machine learning methods.
- Satellite images are visible on prelive webpage and open for users. Sentinel-1 and Sentinel-3 satellite images are also available for users via WMS service.

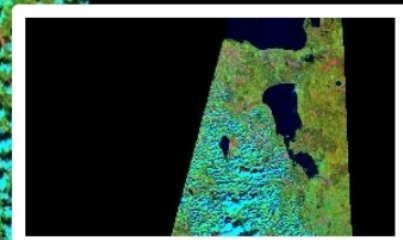
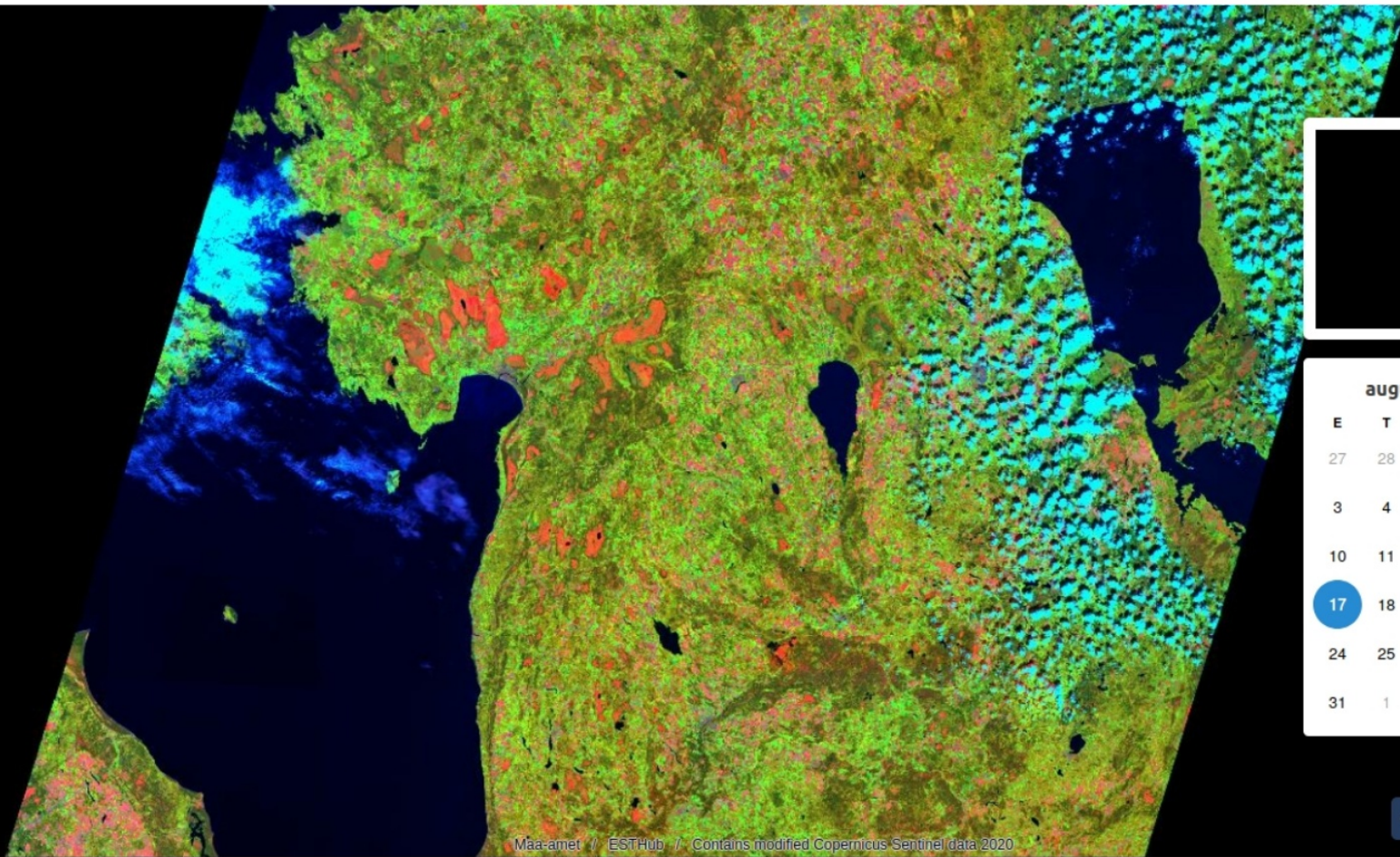
satiladu.maaamet.ee

- Satellite images over Estonia and neighborhood starting from **July 2015**
- Data are updated on daily basis and become available on the **same evening**
- Historical and up-to-date map of land cover indices, incl. **NDVI** (vegetation), **NDPI** (water bodies)
- Possibility for creating and **sharing of original map layers**

satiladu.maaamet.ee



1:1



august 2020

| E | T | K | N | R | L | P |
|----|----|----|----|----|----|----|
| 27 | 28 | 29 | 30 | 31 | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 1 | 2 | 3 | 4 | 5 | 6 |



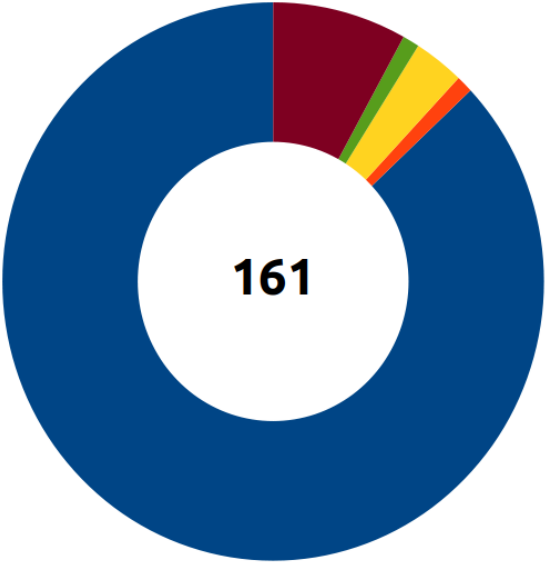
25 km



2020-08-17 PNB

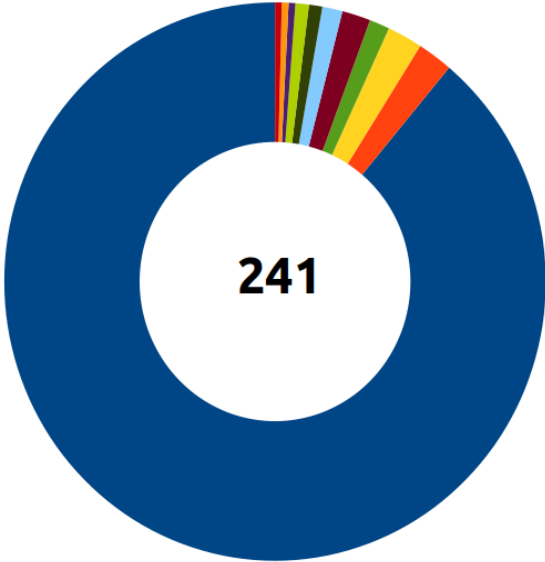
Distribution of users by country

2019



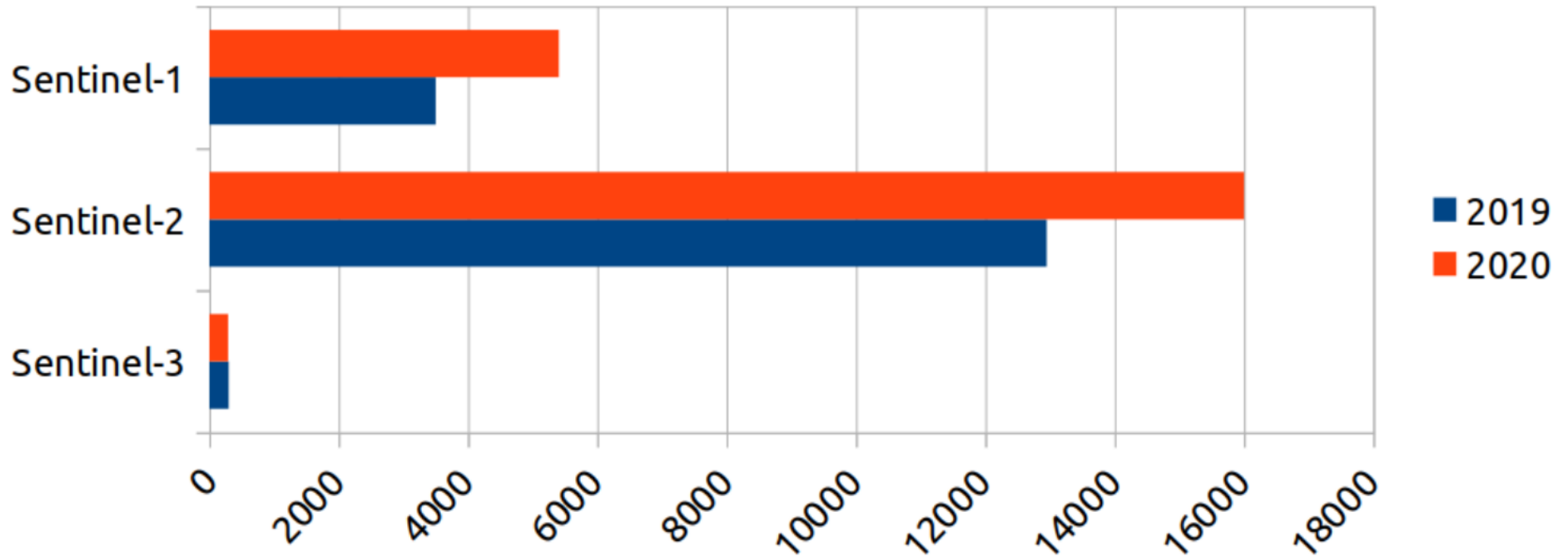
- Estonia
- Latvia
- Lithuania
- Germany
- other

2020

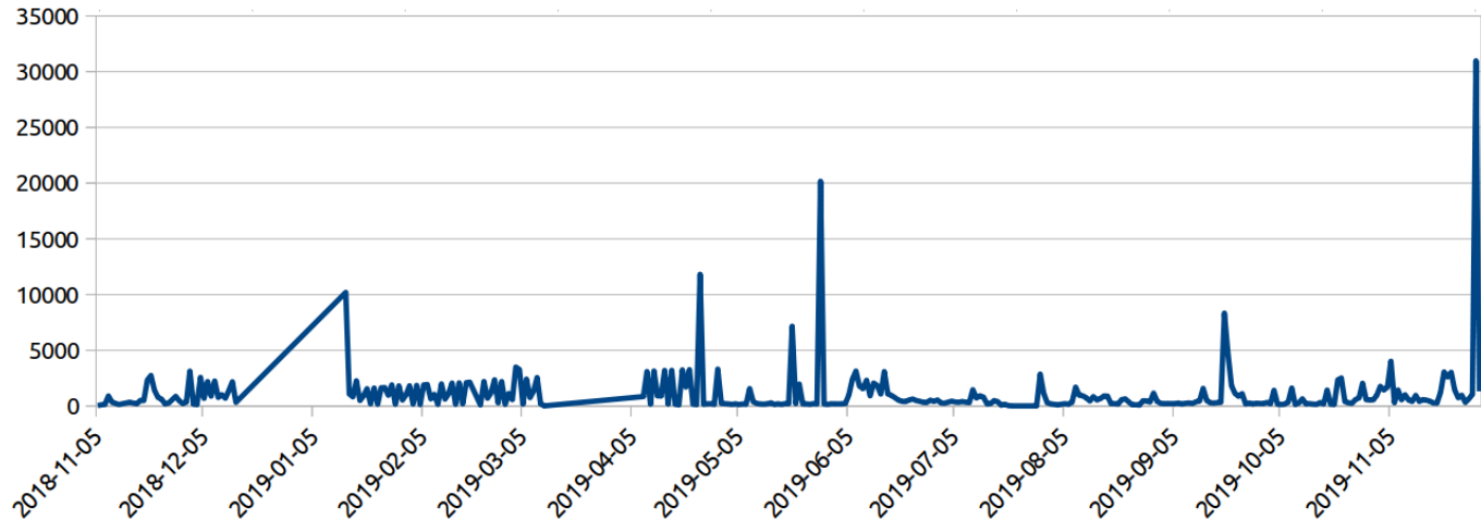
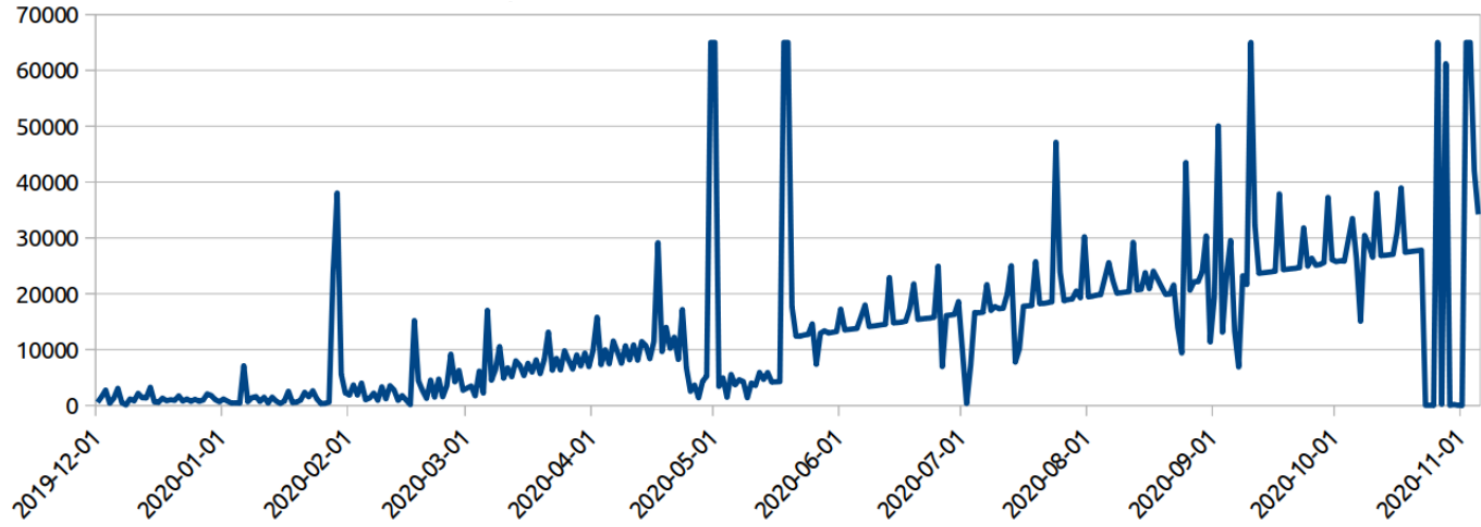


- Estonia
- Latvia
- Lithuania
- Germany
- Sweden
- Finland
- Mexico
- Taiwan
- Brazil
- Falkland Islands
- other

Number of distributed EO products per year



Number of processed EO products per day





Conclusion

- In Estonia **every citizen** can participate in Earth observation via <https://satiladu.maaamet.ee>
- Variety of **ESTHub** usage possibilities is growing rapidly





Thank You!

Questions,
proposals for innovation
and cooperation:

martin.menert@maaamet.ee



MAA-AMET 30 



Government
of Canada

Gouvernement
du Canada

Government of Canada
Copernicus Collaborative Ground Segment
October 18/19, 2021

Canada

Copernicus Mirror [1]

Canada

GC Departments

Environment and Climate Change Canada
Ice Program

What and Who?:

Defense: Ocean feature detection and analysis; and ship detection and surveillance. S1 L1 and L2 radial velocity (RVL) products are used and evaluated with RADARSAT

Environment: S1 L1 GRD for sea ice motion datasets (e.g. automated daily Pan-Arctic motion, sub-daily regional AOIs) for collaborators working in Operations and Academic Research.

How: High-speed download over CANARIE (CA) <-> GEANT (EU) using transfer system (OpenSearch, Postgres, web staging)

Why?: Centralizing data access capitalizing on high speed connetions.

Where: A few hops all in Ontario, Canada

NRCan / CCMEQ

Product Transfer System
OpenSearch, OData

EODMS
Geospatial Search, API, Access, Order Management, Watch Orders

Data Delivery Service (DDS)
Public, Secure

Multi Mission Archive (MMA)
Secure

esa

Collaborative Data Hub
ESA

Science Data Hub
ESA

Download Report
2021-04-01 to 2021-10-10

S1 Alltime Count: 438108
 S1 Alltime Volume: 221 TB
 S1 YTD Count: 41910
 S1 YTD Volume: 21 TB
 S2 Alltime Count: 1476
 S2 Alltime Volume: 1 TB
 S2 YTD Count: 0
 S2 YTD Volume: 0 TB
 S3 Alltime Count: 6969
 S3 Alltime Volume: 3 TB
 S3 YTD Count: 6969
 S3 YTD Volume: 3 TB



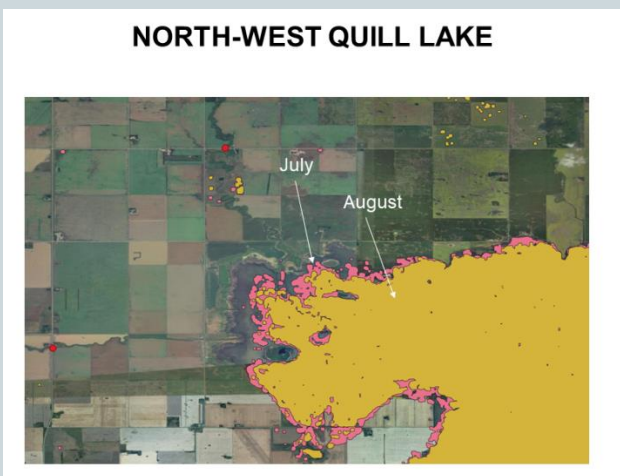
Government of Canada

Gouvernement du Canada



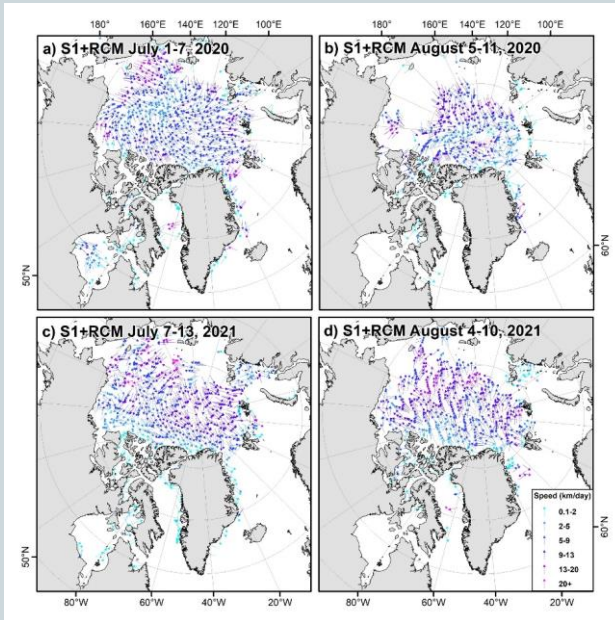
Canada

Copernicus Mirror [2] – Environment Canada



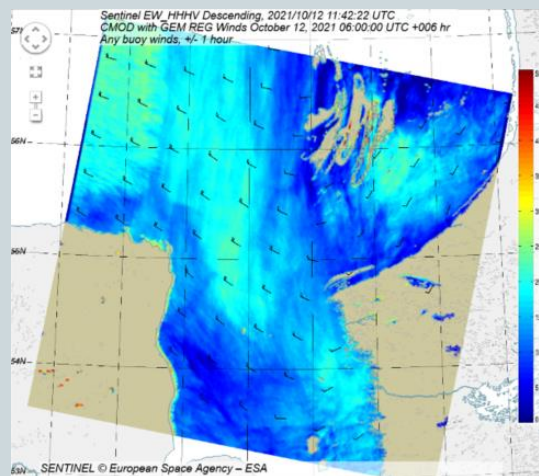
National Surface Water Analysis (NWSA)

Figure 1. Processed S-1 data showing surface water extent over the N-W corner of Quill Lake, SK.
Credit: Doug Stiff, Dikra Khedhaouria, and Yu Wei



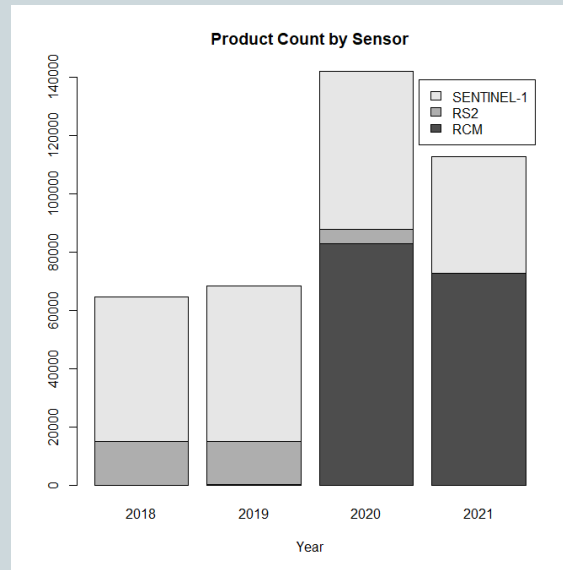
Ice Dynamics

Sample Ice Motion Products Generated from S1 and RCM:



Marine Wind Speed

Sample Ice Motion Products Generated from S1 and RCM



Sea Ice, Ice Shelf, Lake Ice and Iceberg Monitoring, Integrated Satellite Tracking Of Pollution (ISTOP)

Product Count by Sensor



Space Based Earth Observation Next Generation Ground Segment

☀️ Antenna Capacity

🏠 Federated Ground Segment

⚡ Analysis Ready Data & Infrastructure

Antenna Capacity ⚡

Augment existing capacity at the NRCan satellite station facilities and provide redundancy.

Store. Access. Use ⚡

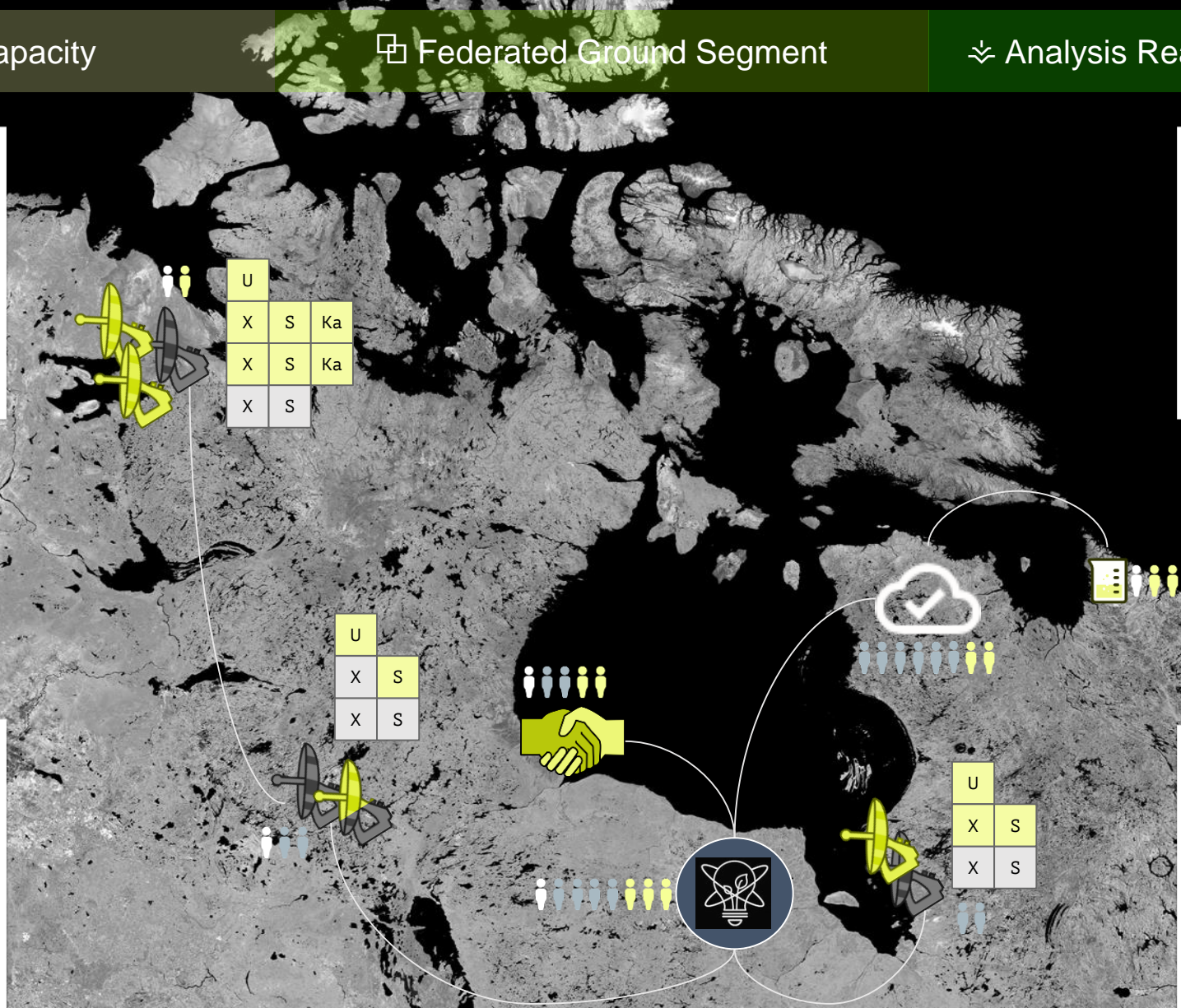
Economical storage and access of growing data. **Increased COPERNICUS Mirror.** Analysis Ready Data and Products (ARDP)

Academic & Industry ☀️

Encourage experimentation and innovation through the enhancement of the ground segment

Federal Ground Segment ⚡

Coordinate a federated GS to increase cooperation, redundancy, resiliency, and security of operations.



#GCCloud [1]: Security

GOVERNMENT

- Contract owner for the Government of Canada (GC)
- Marketplace tools authorization and Supply Chain Integrity Assessment (<https://cyber.gc.ca/en/guidance/cloud-service-provider-information-technology-security-assessment-process-itsm50100>)
- Federated user authentication provided out of Azure.

DEPARTMENT

- * Provisions cloud accounts for admins to their work.
- * Environments i.e. SANDBOX, DEVELOPMENT, STAGING, PRODUCTION.
- * Cloud "guardrails" i.e. security policies e.g. encryption levels
- * Data residency data is physically in Canada i.e. ca-central-1

BUSINESS

- * Operates actual EO data archive and access (including public access) elements.
- * Maintains application level security e.g. VPC, web proxy.
- * Serverless computing is preferred over dedicated machines where possible.
- * Principal of least privilege is used around all data and user access controls.



#GCCloud [2]: Costing

NUTSHELL

- **Storage** savings is **profound**. Data centre costs were high initially w/ lower on-going. AWS is pay-what-you-use. End result is significantly lower O&M.
- AWS **compute** and **network** egress are new costs, but negligible. Impressive to "lift and shift" what we have as-is from data centre i.e. low barrier to entry.

NEXT STEPS

- Next steps: Convert "expensive" compute into so-called, "cloud native" a.k.a. microservices which costs about 1/10.
- Run core modified COTS and then slowly breakdown monolith into microservices, maximizing open source (e.g. STAC) and interoperability (e.g. OGC)



Digital Earth Canada

- GC initiative envisaged as a cloud-based exploitation platform leveraging the existing geospatial infrastructure for the Canadian Government (leads: CSA, NRCan, ECCC, AAFC).
- Will provide a secure digital environment for innovative collaboration between a broad community of users (Government, Industry and Academia).
- Will lower barriers to accessing spaced-based EO data by:
 - Removing the need for data downloads,
 - Providing facilities for processing data at scale, and
 - Addressing current inefficiencies where multiple users process and store the same data repeatedly.
- DEC workflow will integrate various EO data sources including Sentinel, for ARD generation and value adding.



| | |
|---|------------------|
| User Requirement Definition | Sept 2021 |
| Options Analysis | Jan – Dec 2022 |
| Initial System Requirement Definition and Implementation Plan | Mar 2023 |
| Initial Prototype | Sept 2023 |
| Availability of Platform | 2024+ |

