

# Introduction to data processing using OpenEO and Terrascope

## EO4GEO EO Tools

Hande Erdem

VITO

# EO4GEO

We are supporting EO4GEO vision by providing a **fully prepared environment** through [Terrascope](#) platform and **hiding** software processing **complexity** through [OpenEO](#), allowing users to focus on their domain.



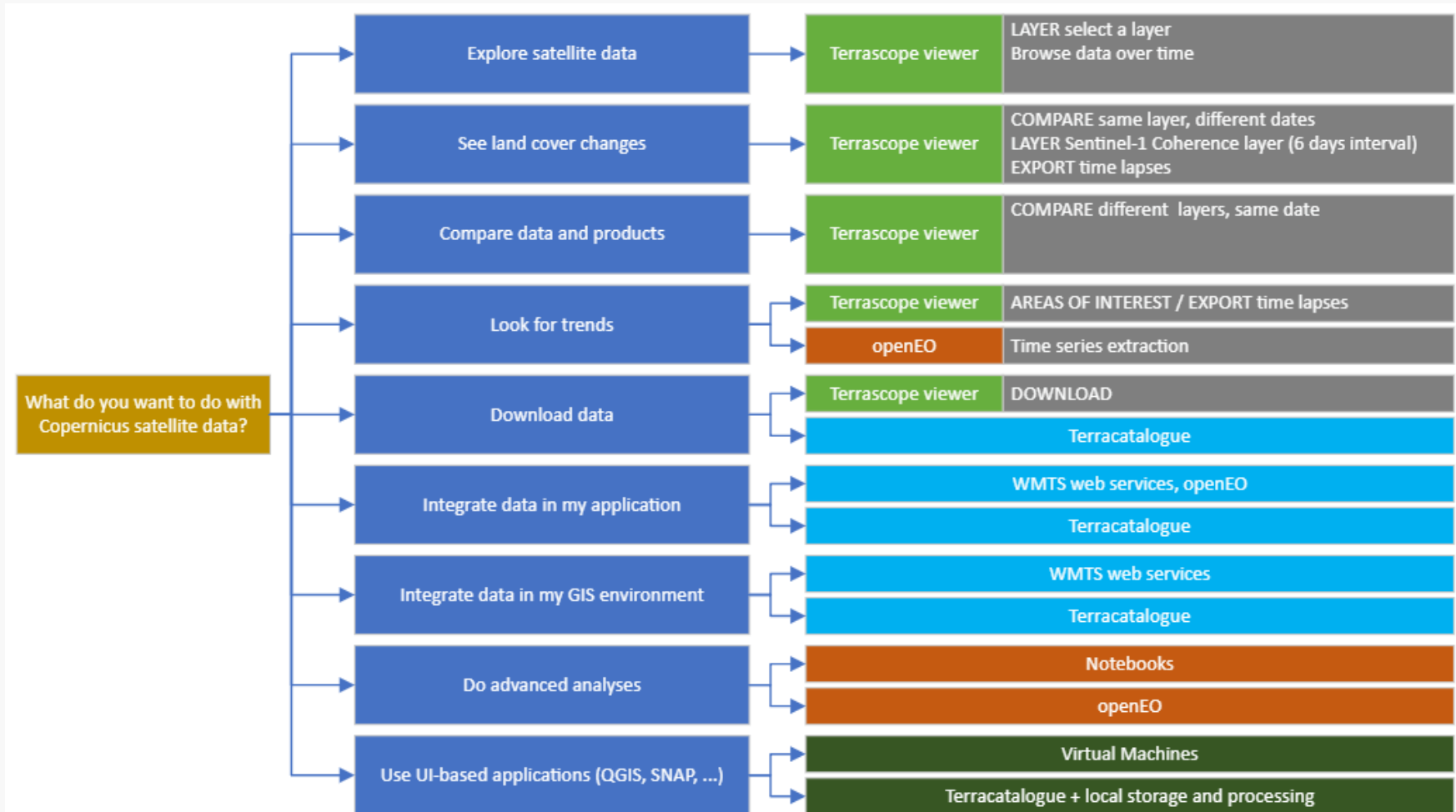
## What is Terrascope?

- Belgian Collaborative Ground Segment for Sentinel missions
- **Easy access to**
  - satellite data
  - products derived from satellite data
  - services (OGC web services, time series service)
  - cloud processing capacity (Jupyter Notebooks, Virtual Machines, openEO)
- **Enabling platform**
- Open for everyone (scientists, public authority, industry, citizens)
- **Free to use for everyone**
- Funded by BELSPO

## What makes Terrascope stand out?

- **Analysis Ready Data**
  - preprocessed (atmospheric correction, georeferencing, ...)
  - in Cloud Optimized GeoTIFF format
  - not just satellite imagery or data, but also value added products
  - ✓ a unique long term global vegetation data set (from 1998 onwards)
- **Analysis tools**
  - catalogue – where do I find data of interest
  - comparison – see change or different perspectives
  - trend analysis – evolution over time
- **Cloud processing**
  - bring your analysis to the data
  - save on storage and processing power
  - free tier, funding opportunity for higher requirements (Network of Resources)

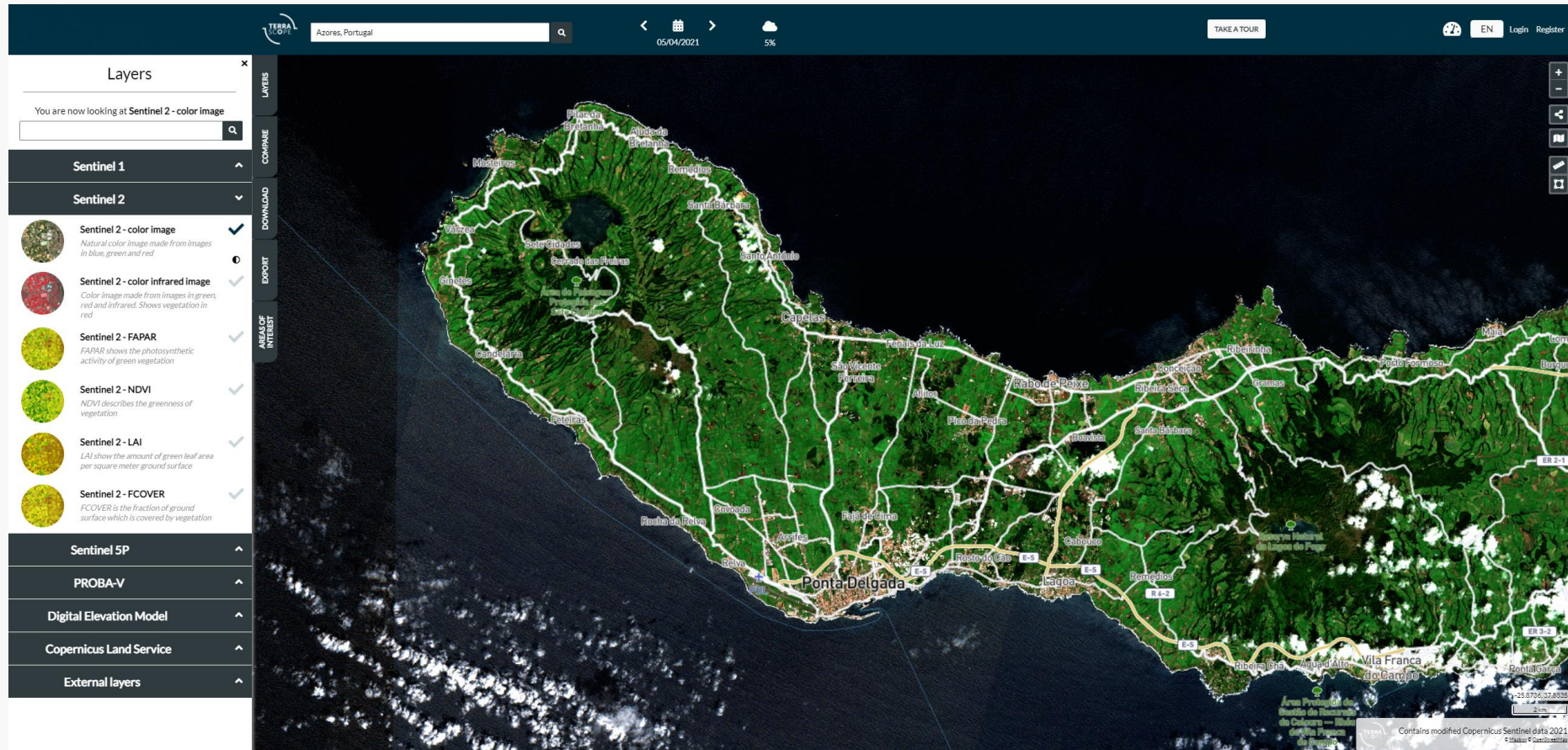
## Service Overview







## Layers



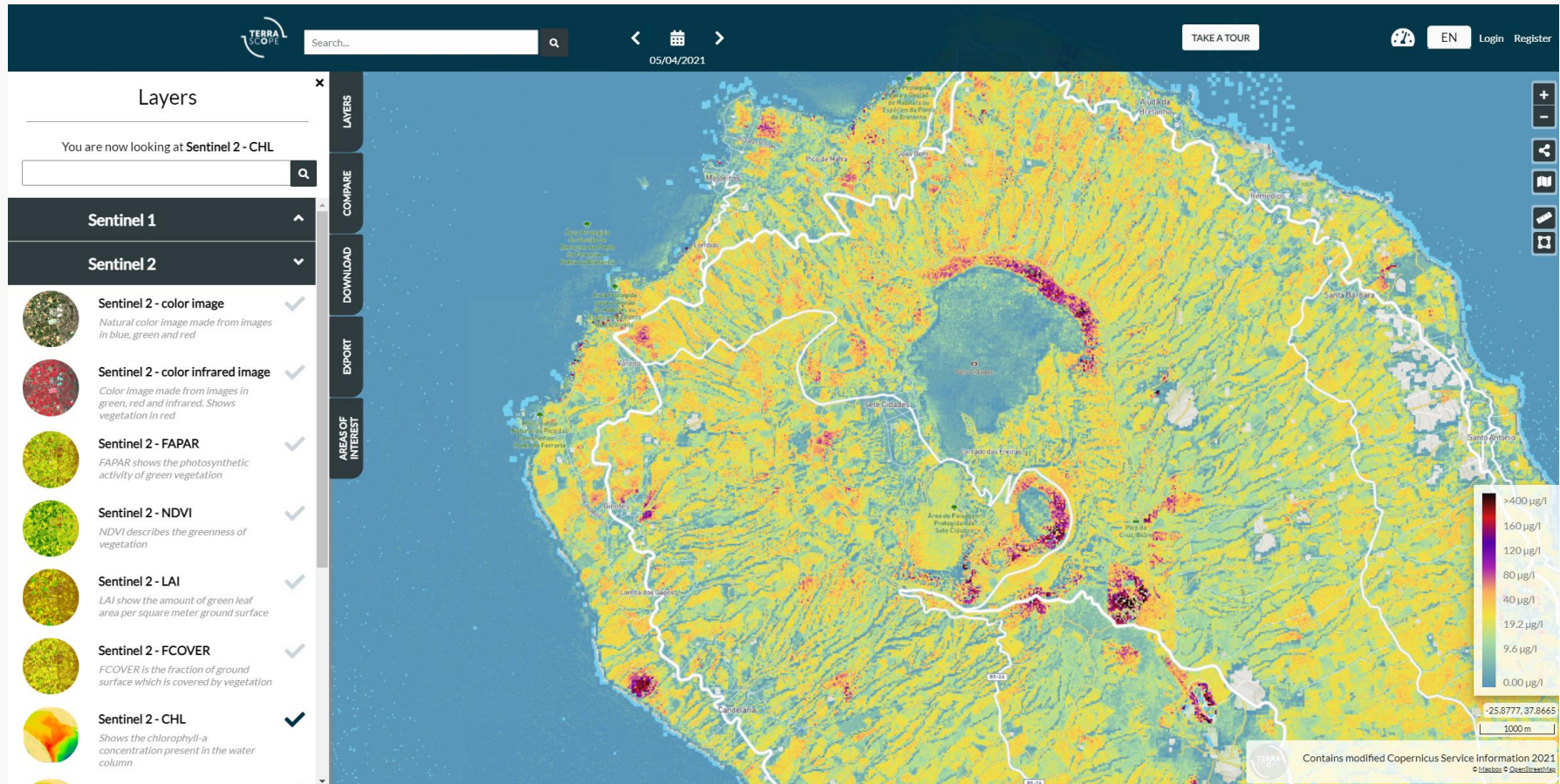
The screenshot shows the Terrascope Viewer interface. At the top, there is a search bar with "Azores, Portugal" entered, a date selector showing "05/04/2021", and a zoom level of "5%". A "TAKE A TOUR" button is also visible. The main map displays a satellite view of the Azores archipelago, with various geographical features and place names labeled. A sidebar on the left contains a "Layers" panel with the text "You are now looking at Sentinel 2 - color image". Below this, there is a list of layers with checkboxes and icons:

- Sentinel 1**
- Sentinel 2**
- Sentinel 2 - color image** (checked): Natural color image made from images in blue, green and red
- Sentinel 2 - color infrared image**: Color image made from images in green, red and infrared. Shows vegetation in red
- Sentinel 2 - FAPAR**: FAPAR shows the photosynthetic activity of green vegetation
- Sentinel 2 - NDVI**: NDVI describes the greenness of vegetation
- Sentinel 2 - LAI**: LAI show the amount of green leaf area per square meter ground surface
- Sentinel 2 - FCOVER**: FCOVER is the fraction of ground surface which is covered by vegetation
- Sentinel 5P**
- PROBA-V**
- Digital Elevation Model**
- Copernicus Land Service**
- External layers**

At the bottom right of the map, there is a small text box that reads: "Contains modified Copernicus Sentinel data 2021".

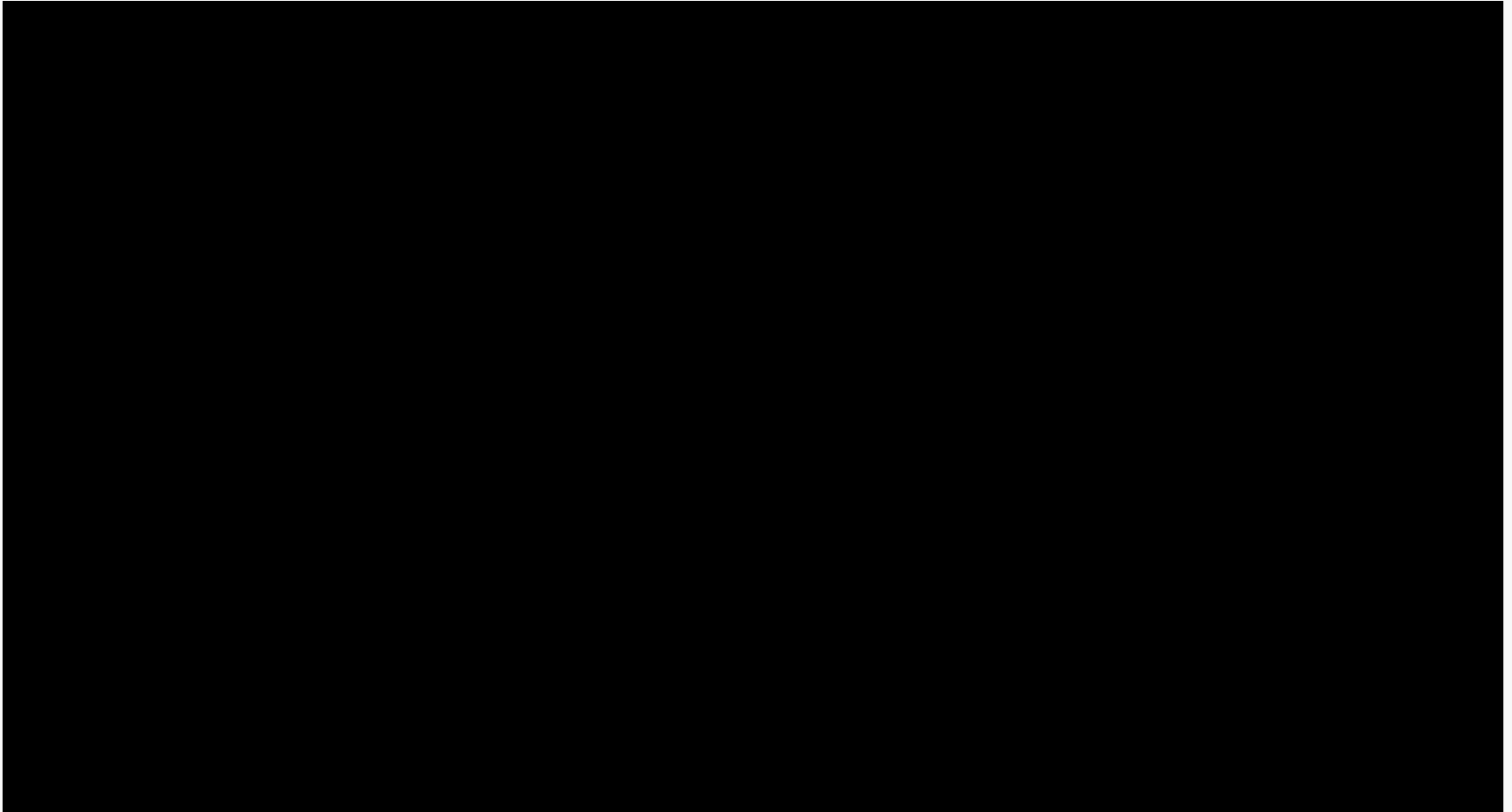


## Layers

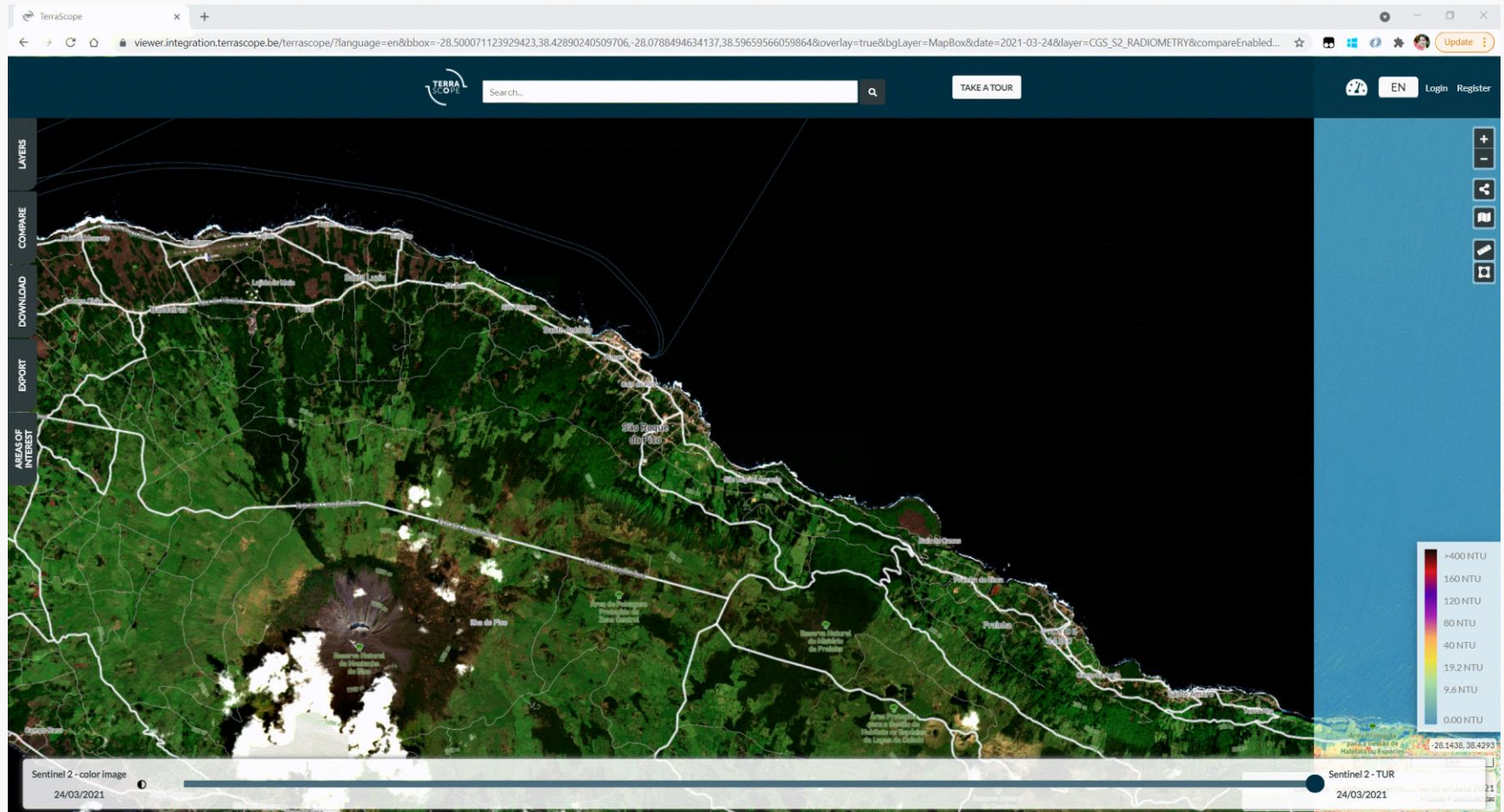




## Compare Images



## Compare Images

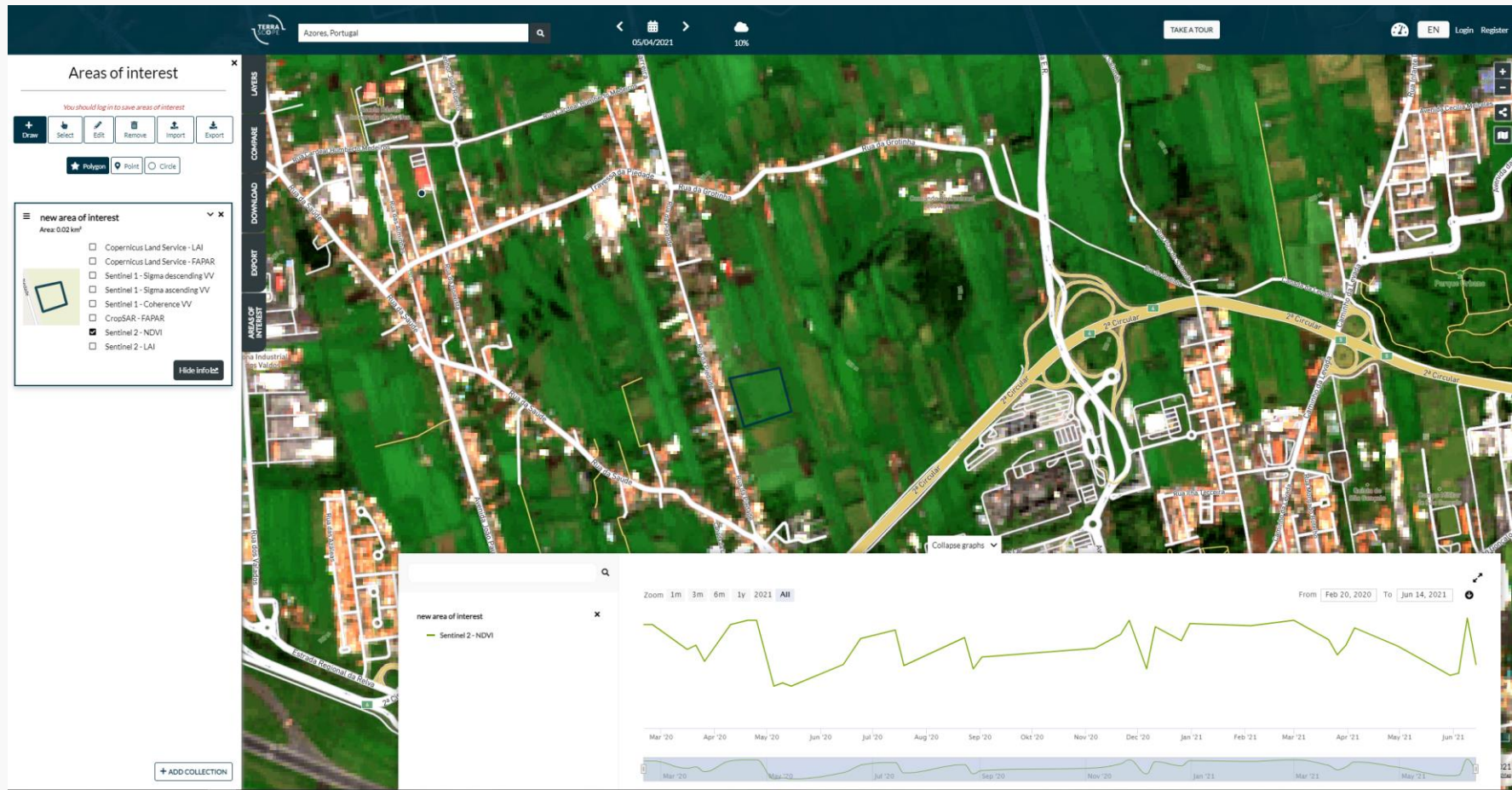


## Timelapse

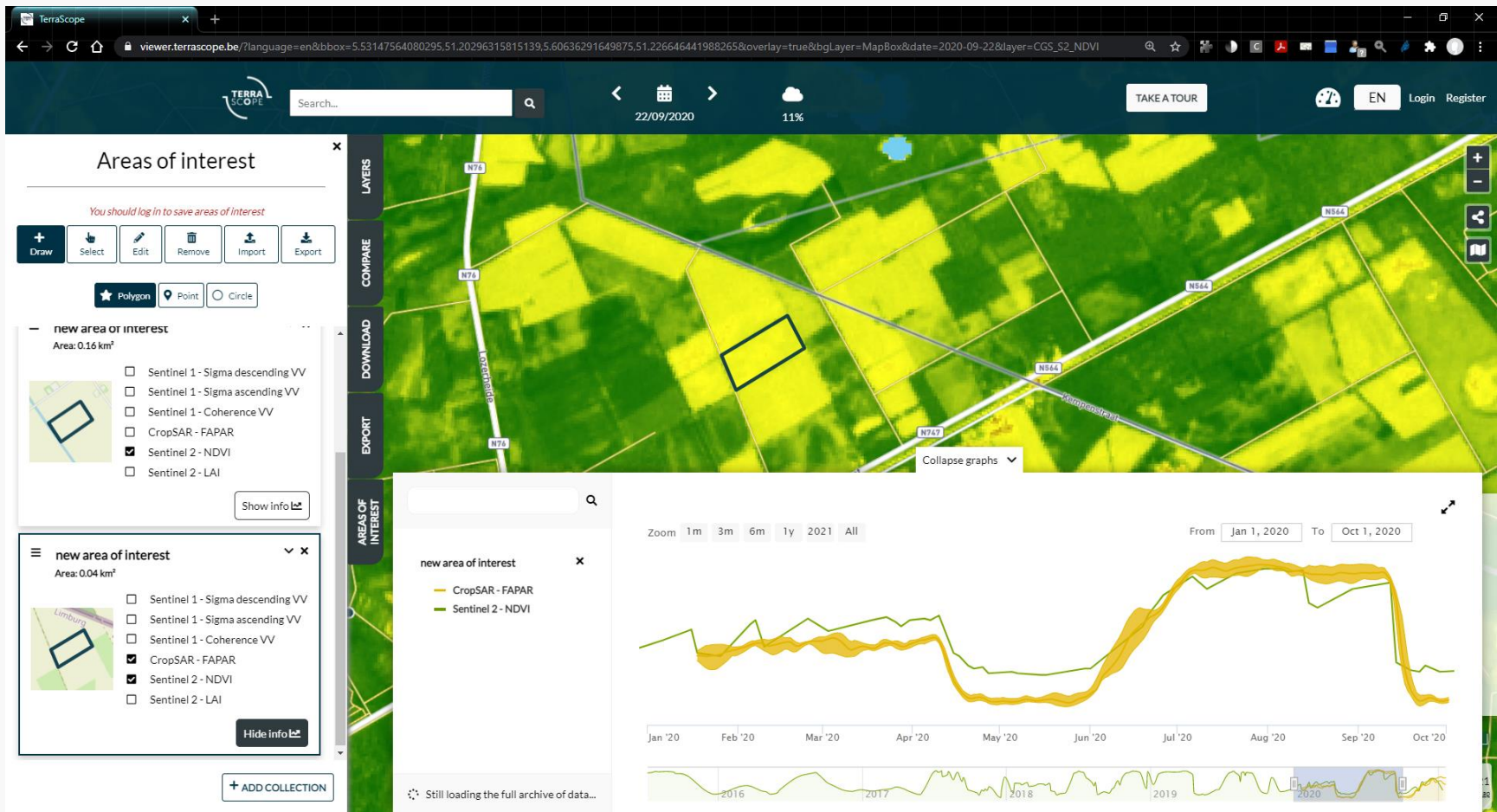




## Areas of Interest

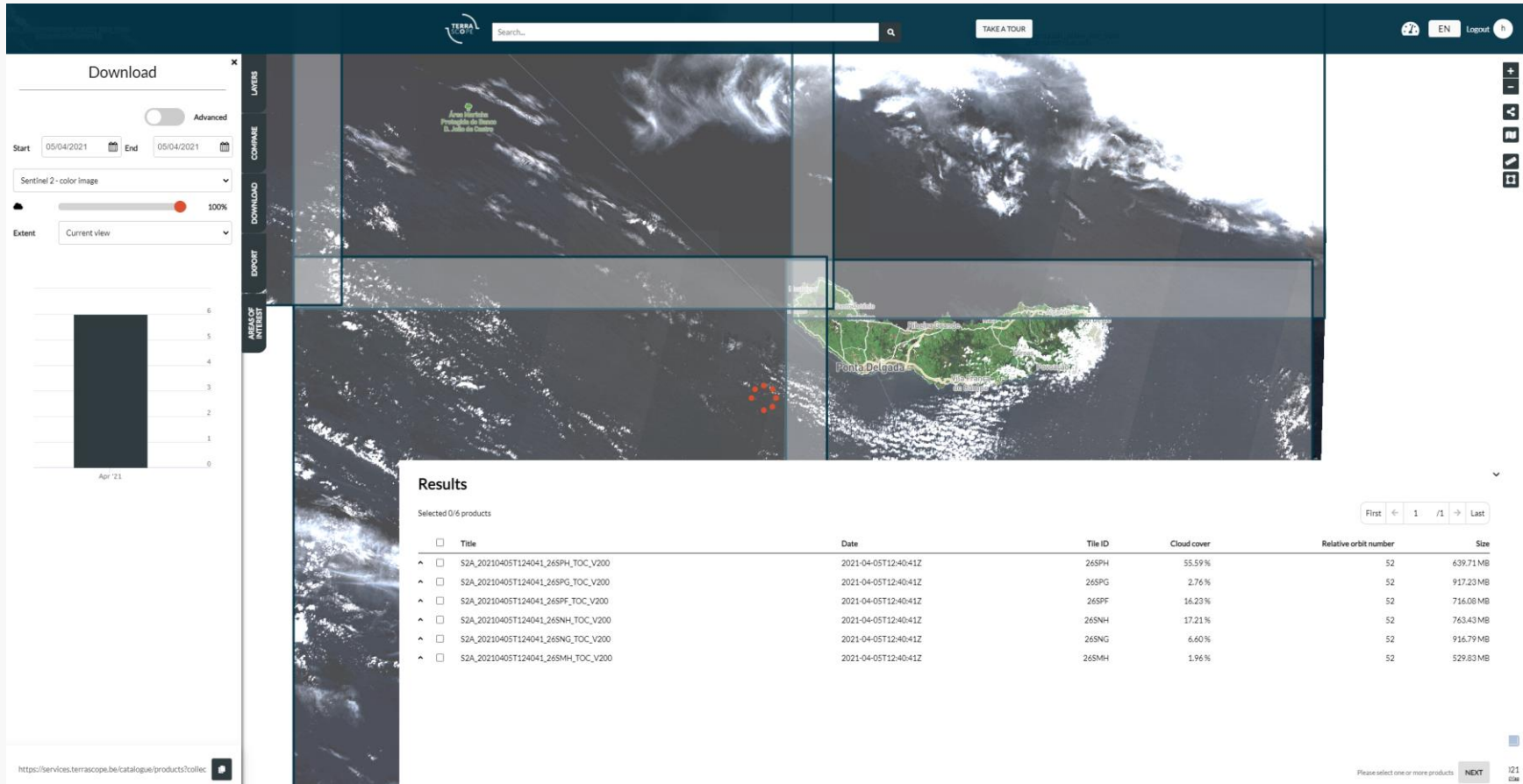


## Areas of Interest





## Download



The screenshot shows the Terrascope Viewer interface. On the left, the 'Download' panel is open, displaying search criteria: Start (05/04/2021), End (05/04/2021), and Sentinel 2 - color image. Below this is a 'Download' button and a 'Current view' dropdown. The main area shows a satellite image of a coastal region with a red circle indicating a point of interest. On the right, the 'Results' panel displays a table of search results.

**Results**

Selected 0/6 products

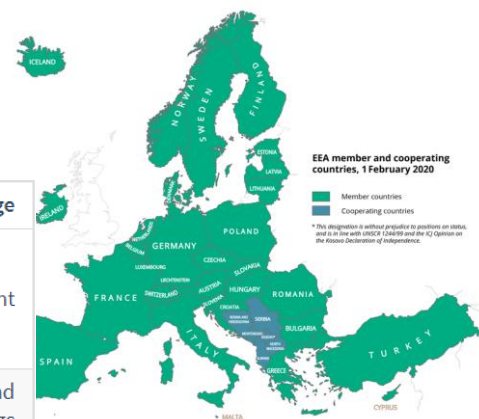
<input type="checkbox"/>	Title	Date	Title ID	Cloud cover	Relative orbit number	Size
<input type="checkbox"/>	S2A_20210405T124041_26SPH_TOC_V200	2021-04-05T12:40:41Z	26SPH	55.59 %	52	639.71 MB
<input type="checkbox"/>	S2A_20210405T124041_26SPG_TOC_V200	2021-04-05T12:40:41Z	26SPG	2.76 %	52	917.23 MB
<input type="checkbox"/>	S2A_20210405T124041_26SPF_TOC_V200	2021-04-05T12:40:41Z	26SPF	16.23 %	52	716.08 MB
<input type="checkbox"/>	S2A_20210405T124041_26SNH_TOC_V200	2021-04-05T12:40:41Z	26SNH	17.21 %	52	763.43 MB
<input type="checkbox"/>	S2A_20210405T124041_26SNG_TOC_V200	2021-04-05T12:40:41Z	26SNG	6.60 %	52	916.79 MB
<input type="checkbox"/>	S2A_20210405T124041_26SMH_TOC_V200	2021-04-05T12:40:41Z	26SMH	1.96 %	52	529.83 MB

At the bottom of the interface, there is a URL bar showing <https://services.terrascope.be/catalogue/products/collec> and a 'NEXT' button.

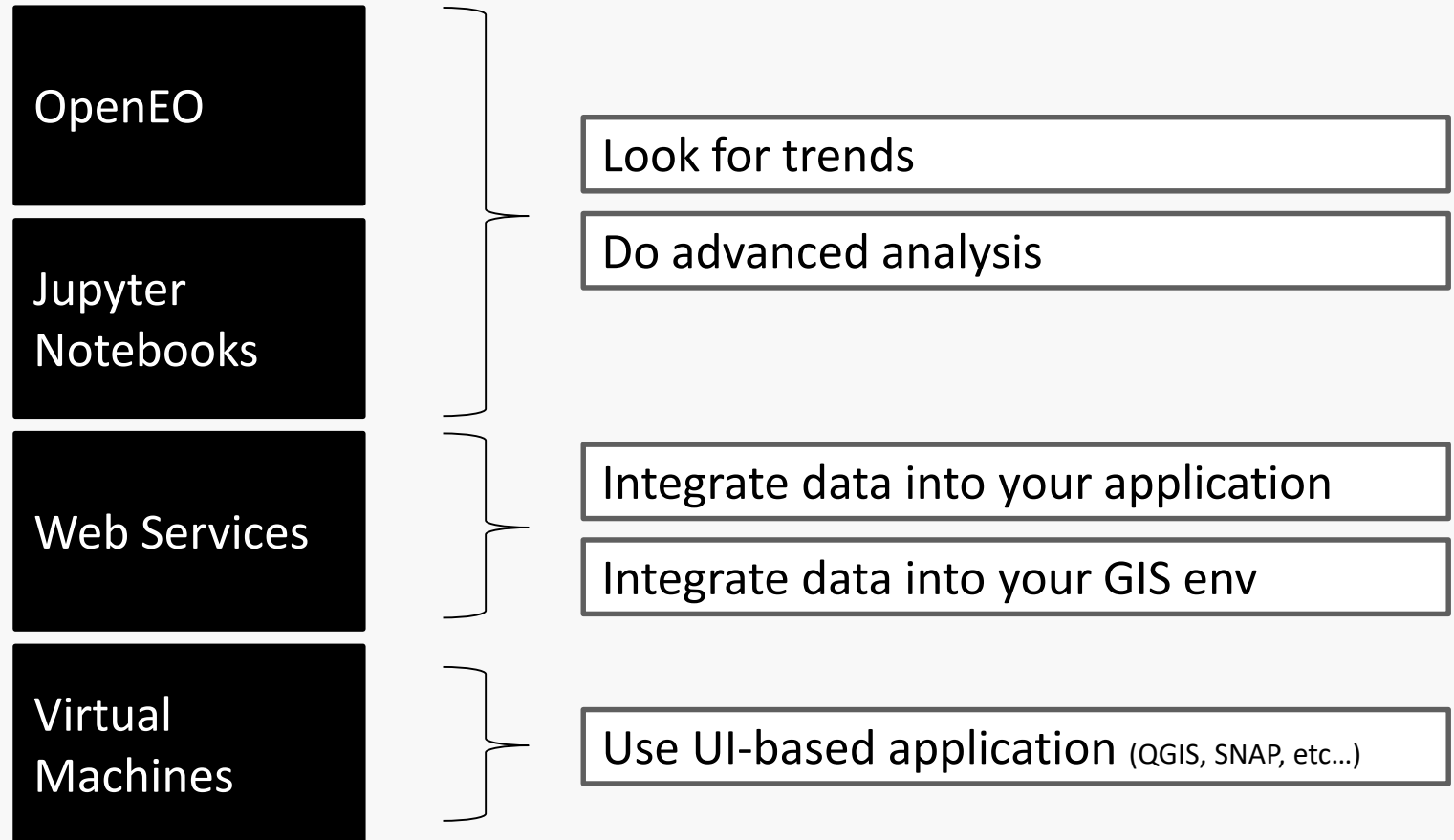


## Product Portfolio

Satellite/Provider	Instrument(s)	Data Products	Available Region	Temporal range
<a href="#">Sentinel-1</a>	C-SAR	<a href="#">GRD</a> <a href="#">GRD <math>\sigma_0</math></a> <a href="#">SLC</a> <a href="#">SLC Coherence</a>	Belgium and surroundings	2015 - present
<a href="#">Sentinel-2</a>	MSI	<a href="#">Level-2A TOC</a> <a href="#">Vegetation Indicators</a>	<a href="#">Europe, Africa, Asia</a>	2015 - present for Belgium and surroundings 2-year rolling archive outside this region
<a href="#">Sentinel-5P</a>	TROPOMI	<a href="#">NO<sub>2</sub></a> <a href="#">CO</a>	Global	2018 - present
<a href="#">PROBA-V</a>	VGT	<a href="#">Level-1C TOA</a> <a href="#">Level-2A TOA</a> <a href="#">Level-3 TOC, NDVI</a>	Global	2013 - 2020
<a href="#">SPOT-VGT</a>	Végétation	<a href="#">Level-2A TOA (VGT-P)</a> <a href="#">Level-3 TOC, NDVI (VGT-S)</a>	Global	1998 - 2014
<a href="#">Copernicus Land Monitoring Service</a>	PROBA-V Sentinel-3 OLCI	<a href="#">S10 LAI</a> <a href="#">S10 FAPAR</a>	Global	2014 - present
<a href="#">Copernicus Digital Elevation Model (DEM)</a>	TanDEM-X	Digital Elevation Model	Global	2011 - 2015



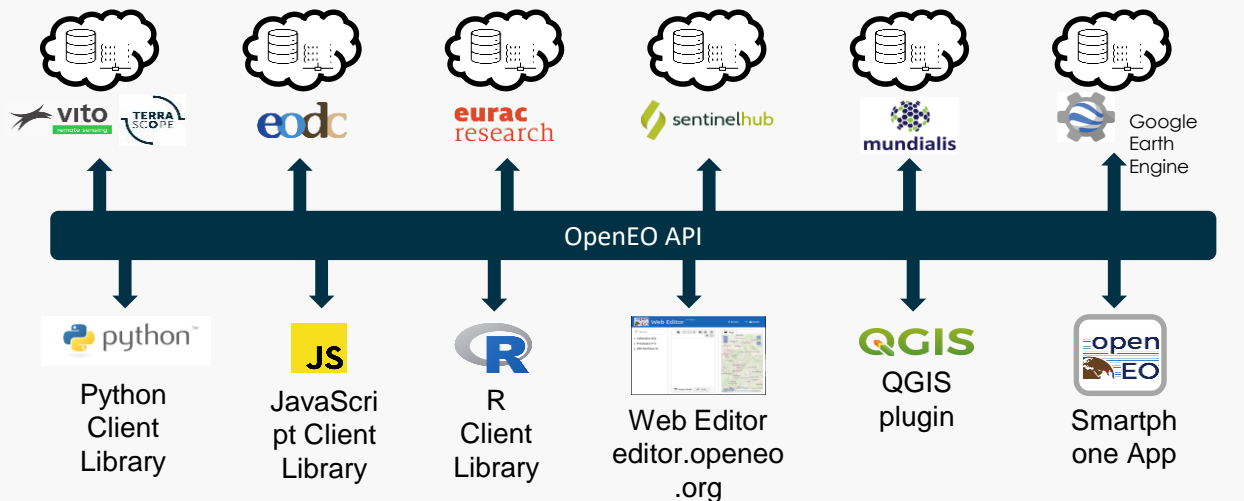
## Services



## What is openEO?

openEO develops an open application programming interface (API) that connects clients like R, Python and JavaScript to big Earth observation cloud back-ends in a simple and unified way.

openEO reduces the complexity of handling large amounts and variety of EO data by implementing a standard, with a focus on large scale processing and time series analysis.

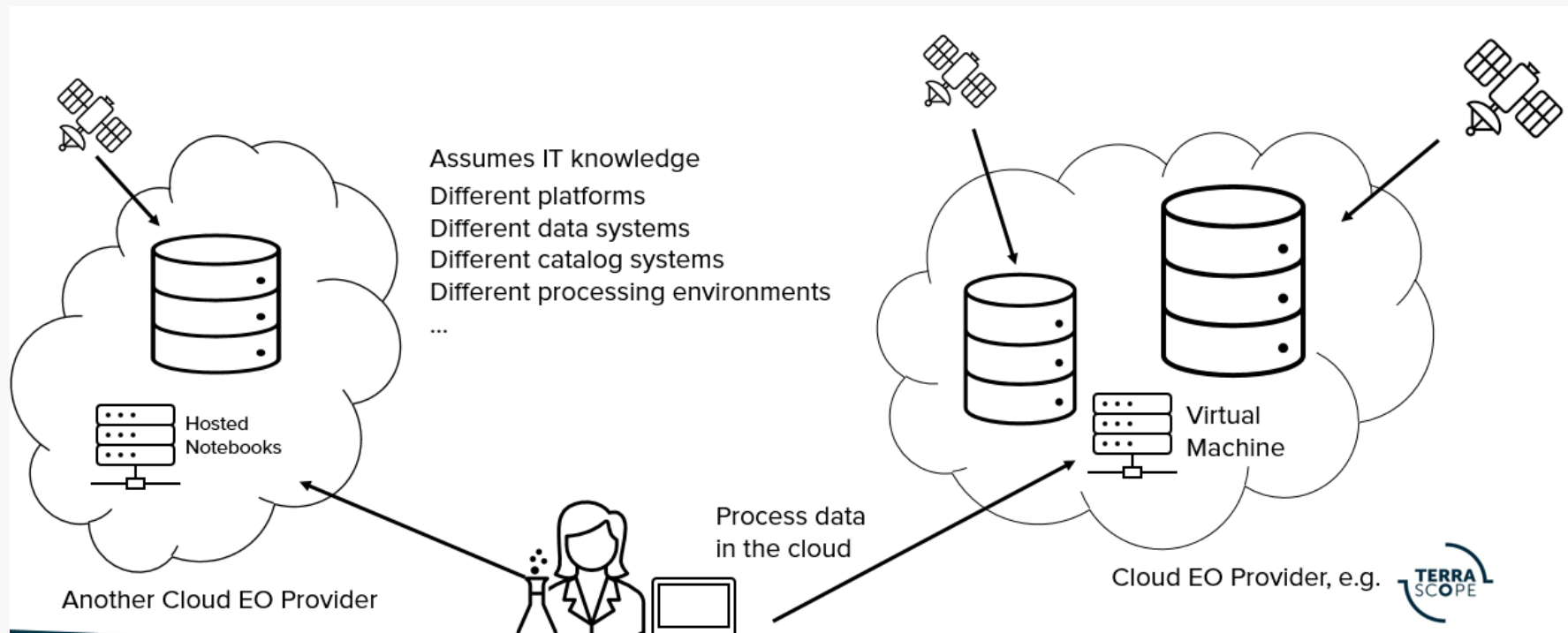




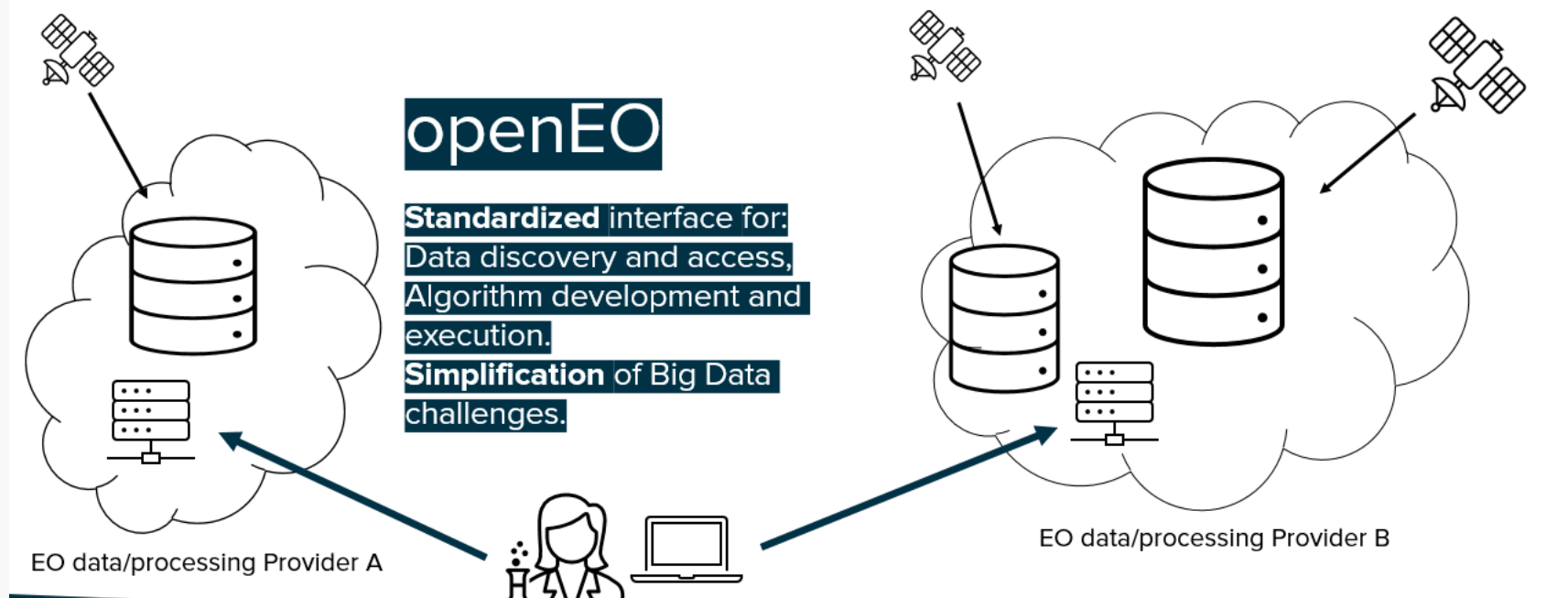
## EO Processing: The Old Fashioned Way



## EO Processing In the Cloud

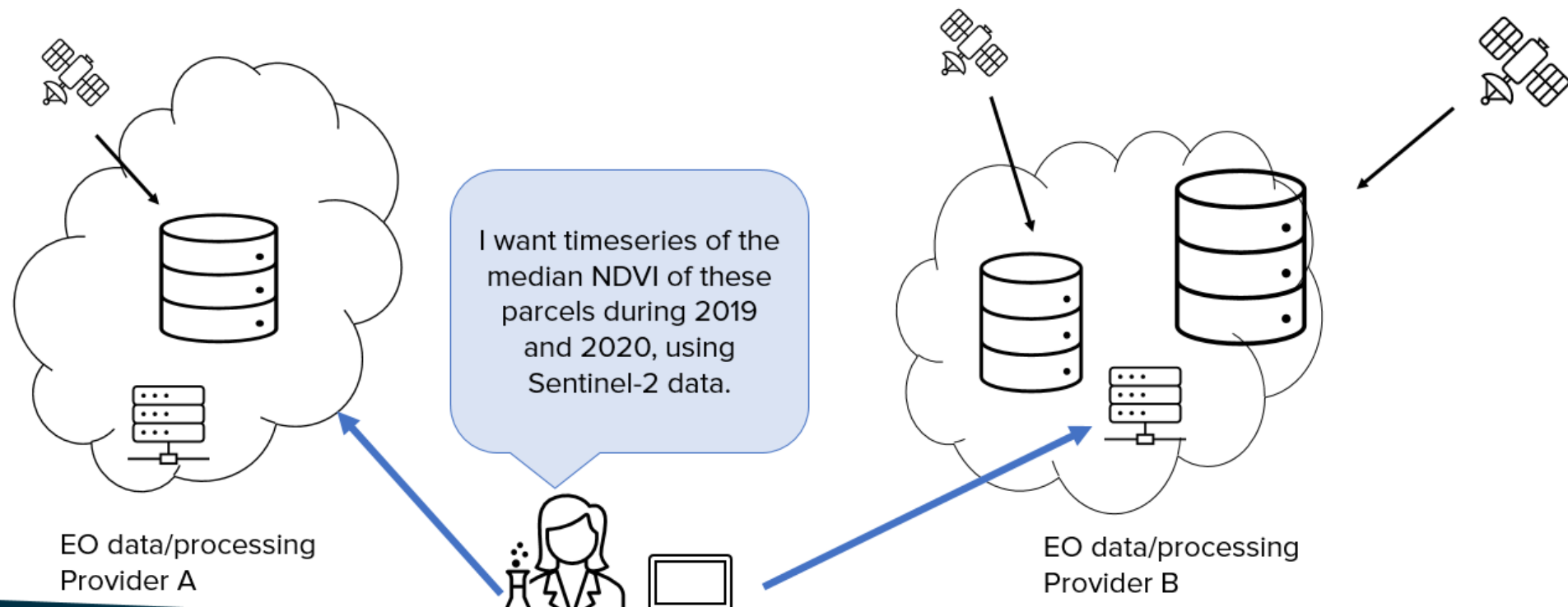


## EO Processing with OpenEO





## EO Processing with OpenEO





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PSC

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## Processes

Search in processes



- Aggregate & Resample (7)
- Arrays (12)
- Climatology (3)
- Comparison (15)
- Cubes (33)
- Development (1)
- Export (1)
- Filter (6)
- Import (5)
- Logic (7)
- Masks (3)
- Math (23)
  - Math > Constants (3)
  - Math > Cumulative (4)
  - Math > Exponential & Logarithmic (6)
  - Math > Image Filter (1)
  - Math > Indices (2)
  - Math > Rounding (4)
  - Math > Trigonometric (14)
- Reducer (18)
- Sorting (3)
- Texts (6)
- Udf (2)
- Vegetation Indices (2)

## add\_dimension

Version: 1.x

CUBES

DOWNLOAD JSON

Add a new dimension

### Description

```
add_dimension(raster-cube:object data, string name, mixed label, ?string type = "other") :
raster-cube:object
```

Adds a new named dimension to the data cube.

Afterwards, the dimension can be referenced with the specified **name**. If a dimension with the specified name exists, the process fails with a **DimensionExists** error. The dimension label of the dimension is set to the specified **label**.

### Parameters

#### data \*

A data cube to add the dimension to.

Data type: **raster-cube (object)**

#### name \*

Name for the dimension.

Data type: **string**

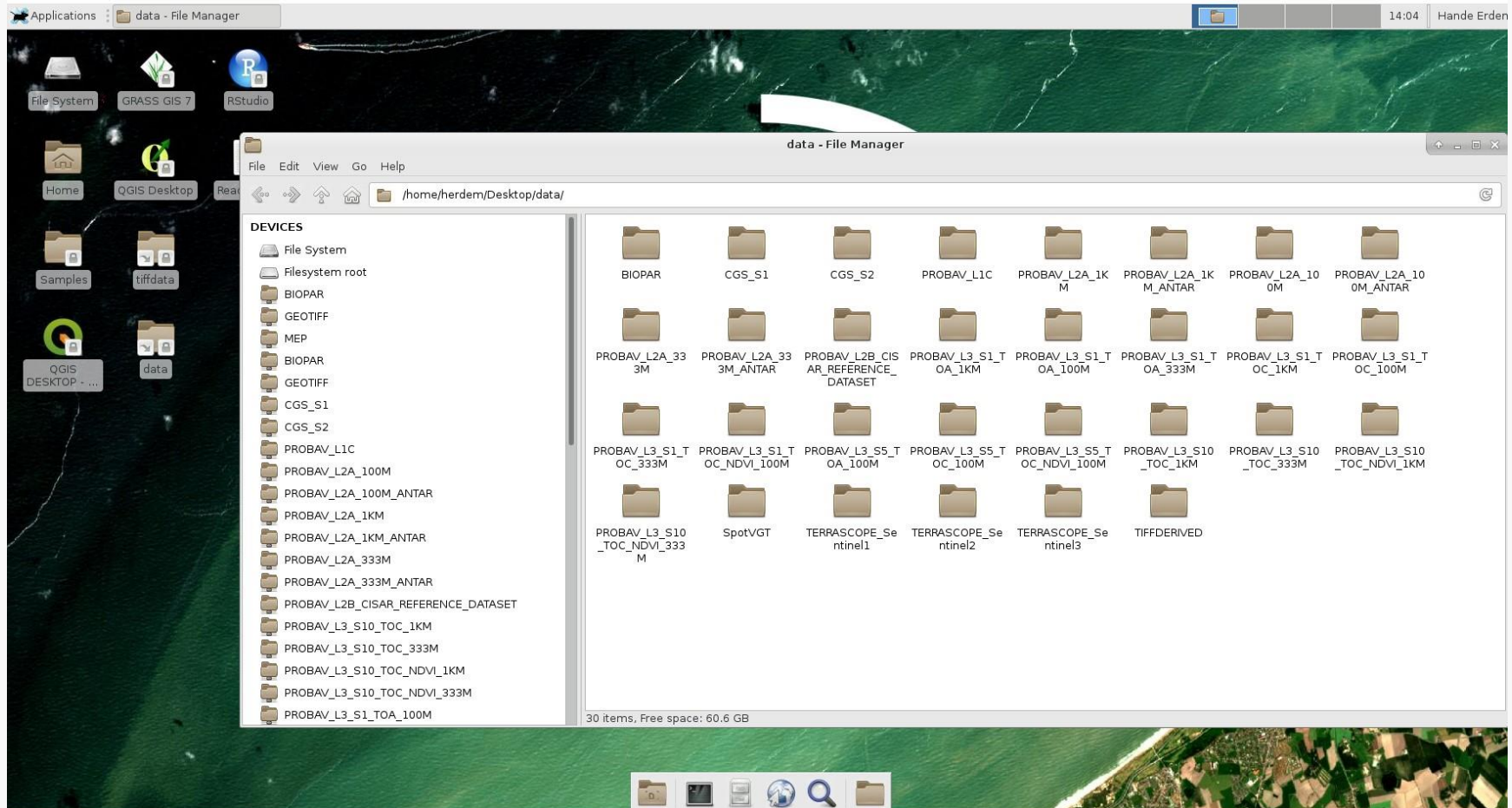
#### label \*

A dimension label.

Data Types:

Data type: **number**

## Virtual Machines



# Thank you!



[www.terrascope.be/en](http://www.terrascope.be/en)



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[www.eo4geo.eu](http://www.eo4geo.eu)



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