

# living planet symposium

BONN  
23–27 May  
2022

TAKING THE PULSE  
OF OUR PLANET FROM SPACE



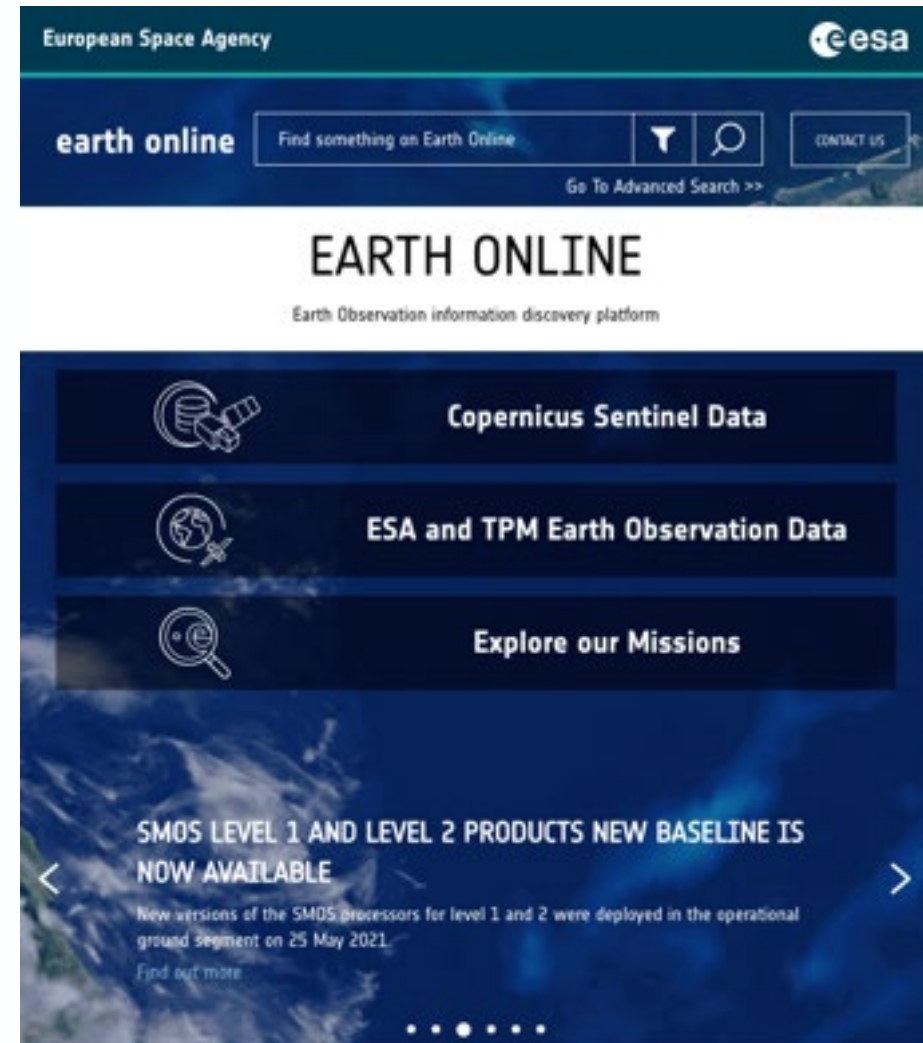
## The European Space Agency PDGS Data Cube service

MEE0: Simone Mantovani, D. Barboni, M. Cavicchi, S. Natali  
ESA-ESRIN: Giuseppe Troina, D. Guerrucci, M. Albani

May 24<sup>th</sup> 2022

ESA's Payload Data Ground Segment (PDGS) provides data access to Earth Observation Missions

Operation of data dissemination services per satellite mission



To make the data  
more FAIR

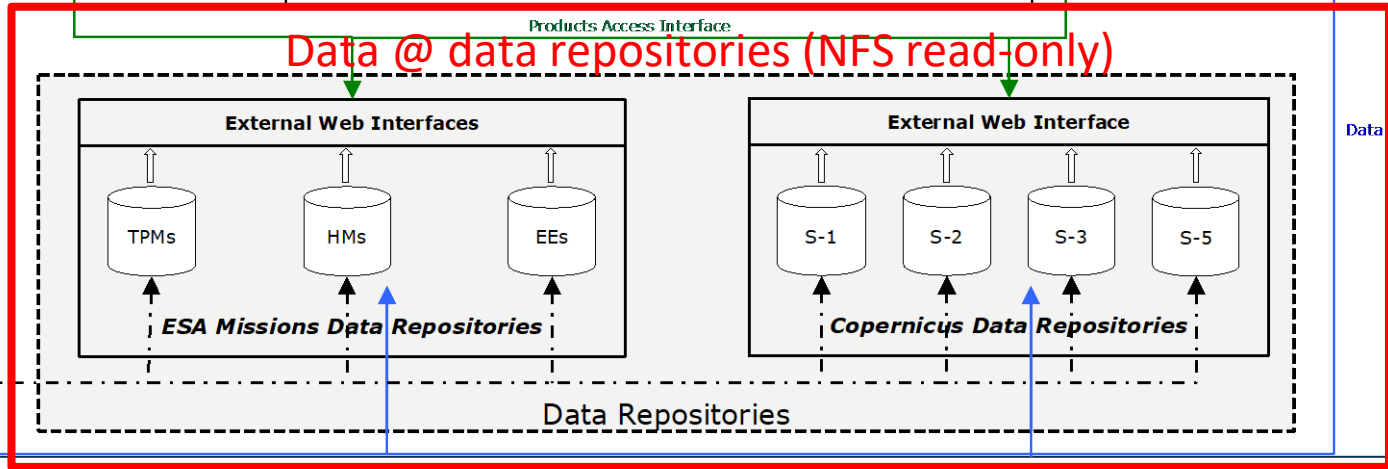
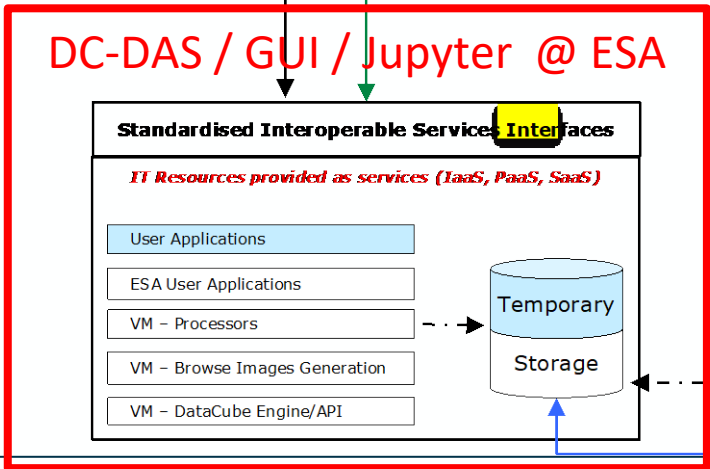
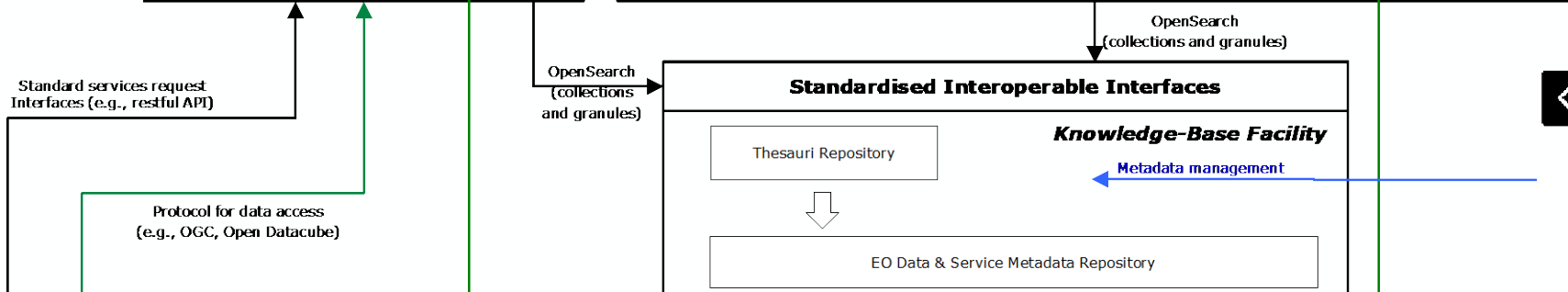
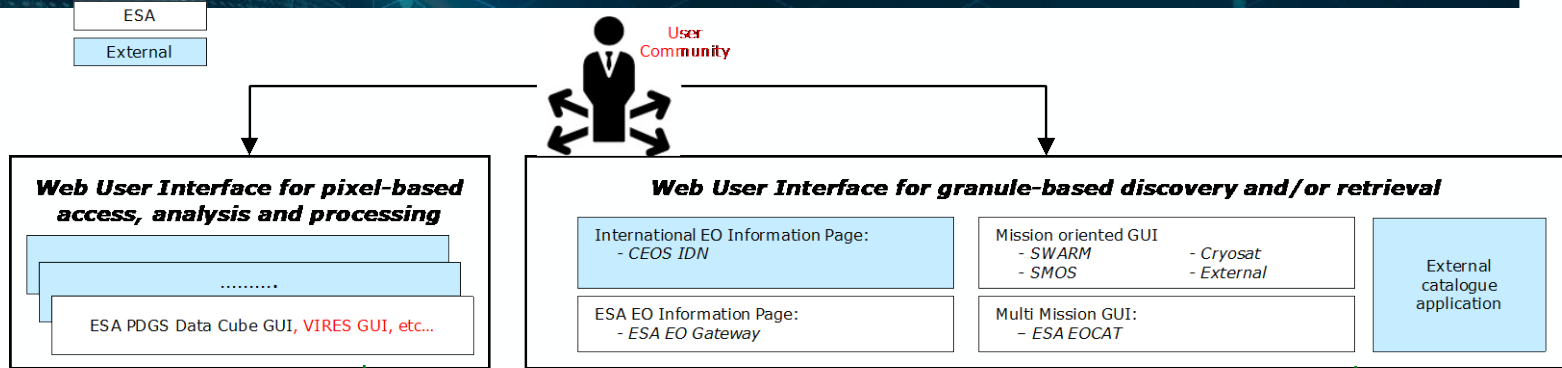
- Findable**
- Accessible**
- Interoperable**
- Reusable**



# PDGS Common Service



- Operational interface
- Query and service requests
- Data access interface
- - > Operational Data Access



ESA's Payload Data Ground Segment (PDGS) provides data access to Earth Observation Missions

Operation of data dissemination services per satellite mission

Service evolution

- **ESA PDGS Data Cube** enables pixel-based access, time series extraction, data subsetting, mosaicking, band combinations, ...
- **human and machine-to-machine interfaces**, including **Jupyter** to import, write and execute code that runs close to the data

**Jupyter:** <https://jupyter.pdgs.eo.esa.int>  
To support scientific data exploitation

**adamapi:** <https://pypi.org>  
To support programmatic / machine-to-machine data exploitation

**Explorer:** <https://datacube.pdgs.eo.esa.int>  
To support human-friendly data visualization (2D / 3D, multi-projections, elevation service, ...)

- Third-Party Missions

Mission	Dataset	Temporal coverage
Landsat-5	LANDSAT.TM.GTC	04/1984 – 11/2011
Landsat- 7	LANDSAT.ETM.GTC	07/1999 – 12/2003
Tropforest	TropForest	07/2006 – 04/2011
SPOT-1-5_ESA	SPOT1-5	04/1986 – 11/2015
IKONOS-2	IKONOS.ESA.Archive	12/2000 – 12/2008
Seasat	SeaSat.ESA.Archive	07/1978 – 10/1978

- Heritage Missions

Mission	Dataset	Temporal coverage
ENVISAT	ENVISAT.ATS.LST_2P	07/2002 - 04/2012
ENVISAT	ENVISAT.ATS.LST_3P	07/2002 - 04/2012
ENVISAT	ENVISAT.UPA-L2P (SST)	05/2002 - 04/2012
ENVISAT	ENVISAT.UPA-L3U (SST)	05/2002 - 04/2012

- Earth Explorer

Mission	Dataset	Temporal coverage
SMOS	L3_sea_ice_thickness	01/2010 - today
SMOS	MIR_SMUDP2	01/2019 - today
SMOS	MIR_OSUDP2	01/2019 - today

**Ongoing development**

# ESA PDGS Data Cube service: Datasets

## Spatial resolution

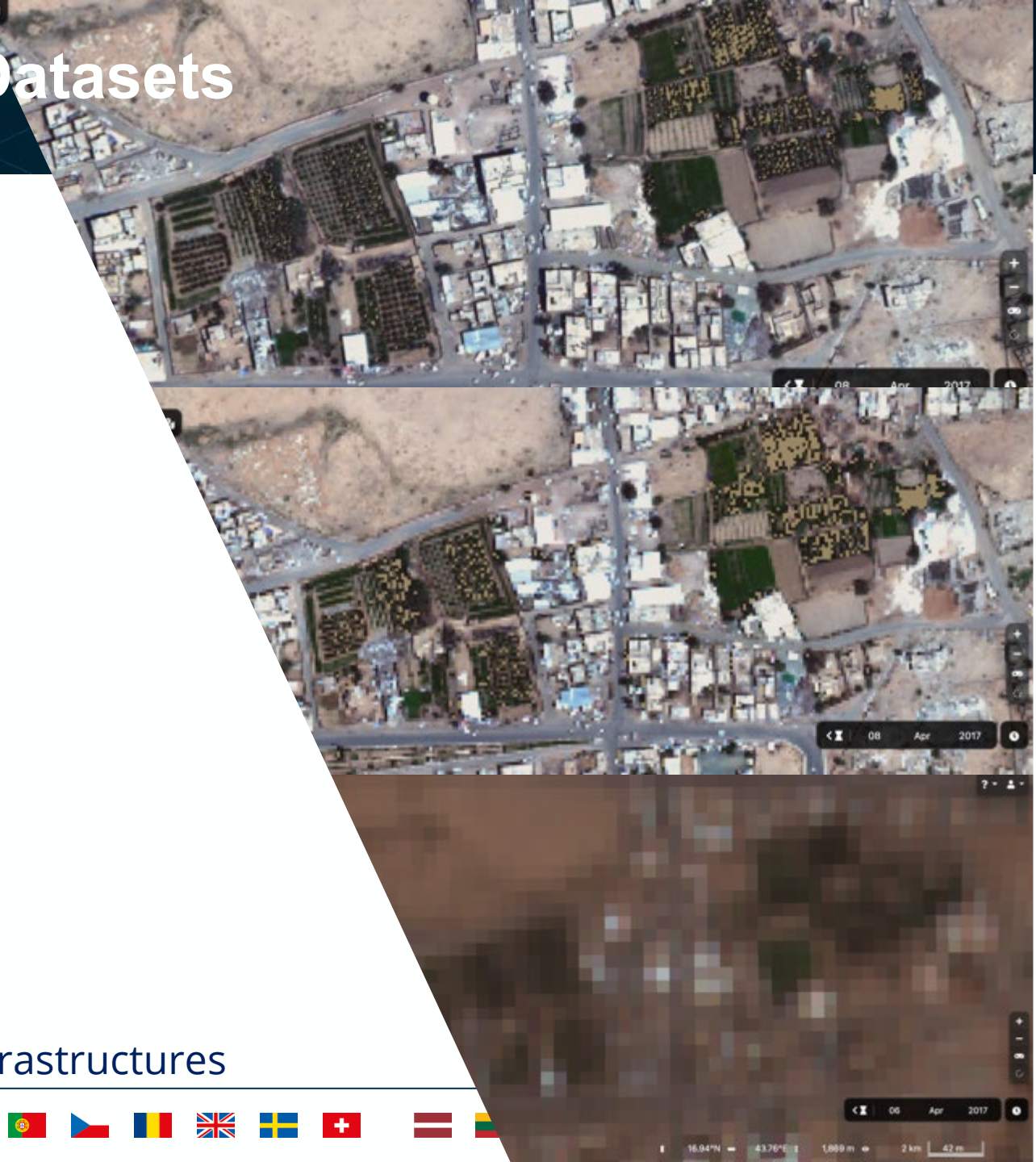
- Gridded / non-gridded
- Resolution
  - Low (+1km)
  - Medium (10 - 100 m)
  - High (1 - 10 m)

## Temporal resolution

- Regular: Hourly, Daily, Monthly, ...
- Irregular: Sparse, Tiled, ...

## Data

- Data formats: TIFF, COG, HDF, NC, ...
- Storage services: NFS, s3, local filesystem, ...
- Data infrastructures: DIAS(es), AWS, private infrastructures



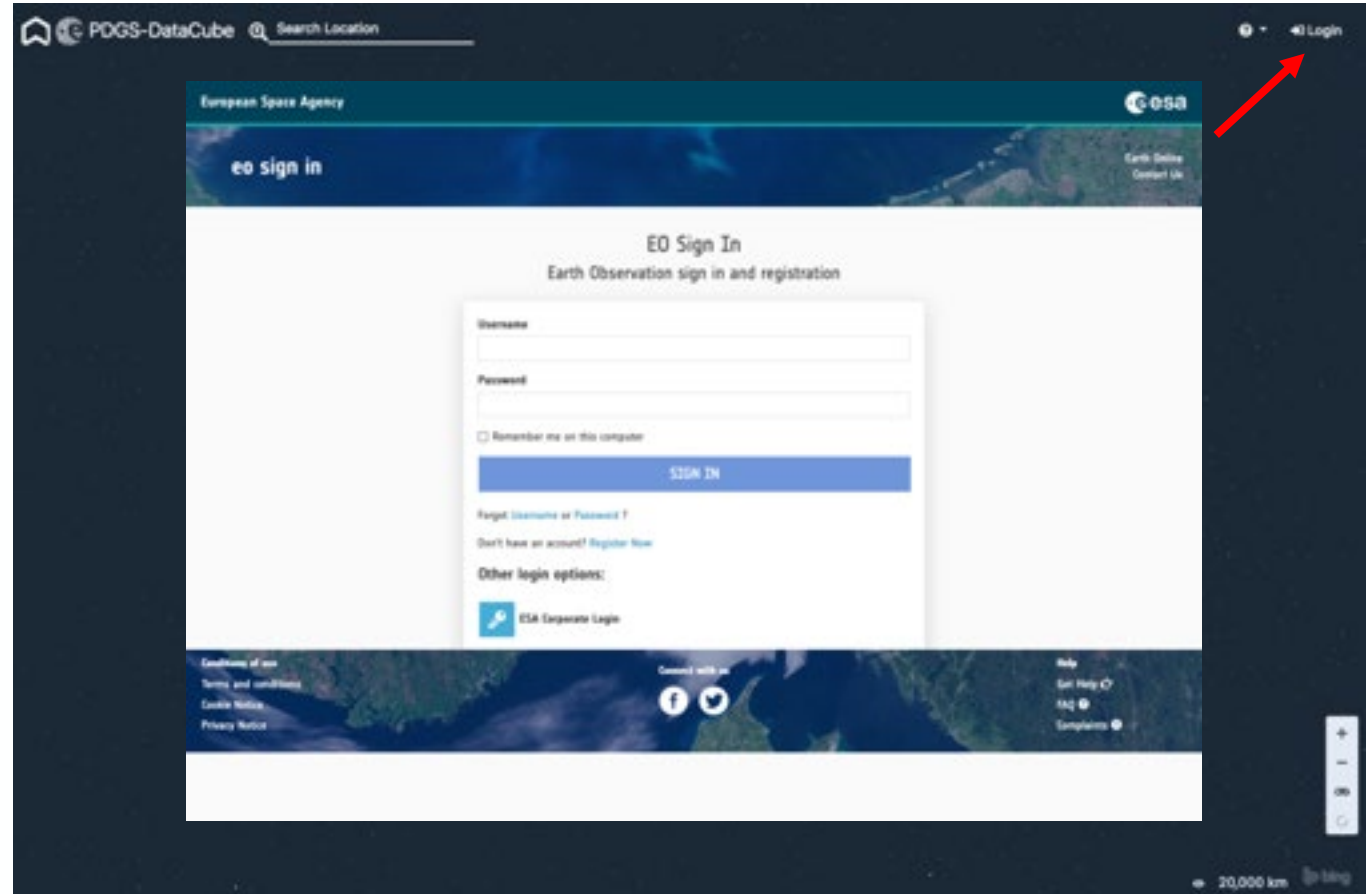
# The dream turned in to a nightmare

<b>Findable</b> 	<b>Persistent Identifiers (PIDs)</b> 	<b>Rich metadata</b> 	<b>Indexed data repositories</b> 	<b>PIDs in metadata</b> 
<b>Accessible</b> 	<b>Standard communications protocol</b> 	<b>Open, free protocol</b> 	<b>Authentication, where necessary</b> 	<b>Metadata is always available</b> 
<b>Interoperable</b> 	<b>Vocabularies</b> 	<b>Vocabularies are FAIR</b> 	<b>Linked metadata</b> 	
<b>Reusable</b> 	<b>Metadata have multiple attributes</b> 	<b>Usage license</b> 	<b>Provenance</b> 	<b>Community standards</b> 

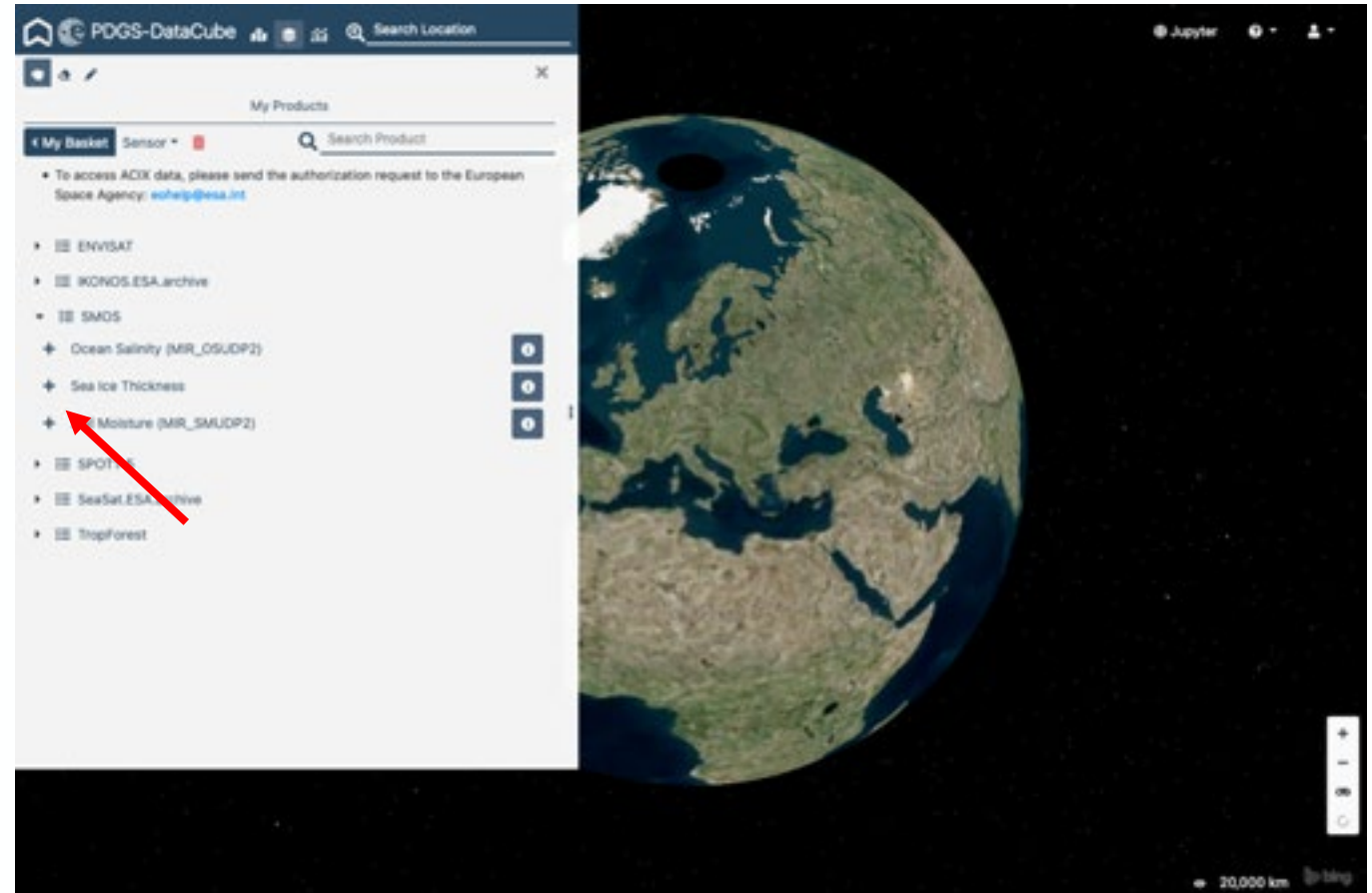




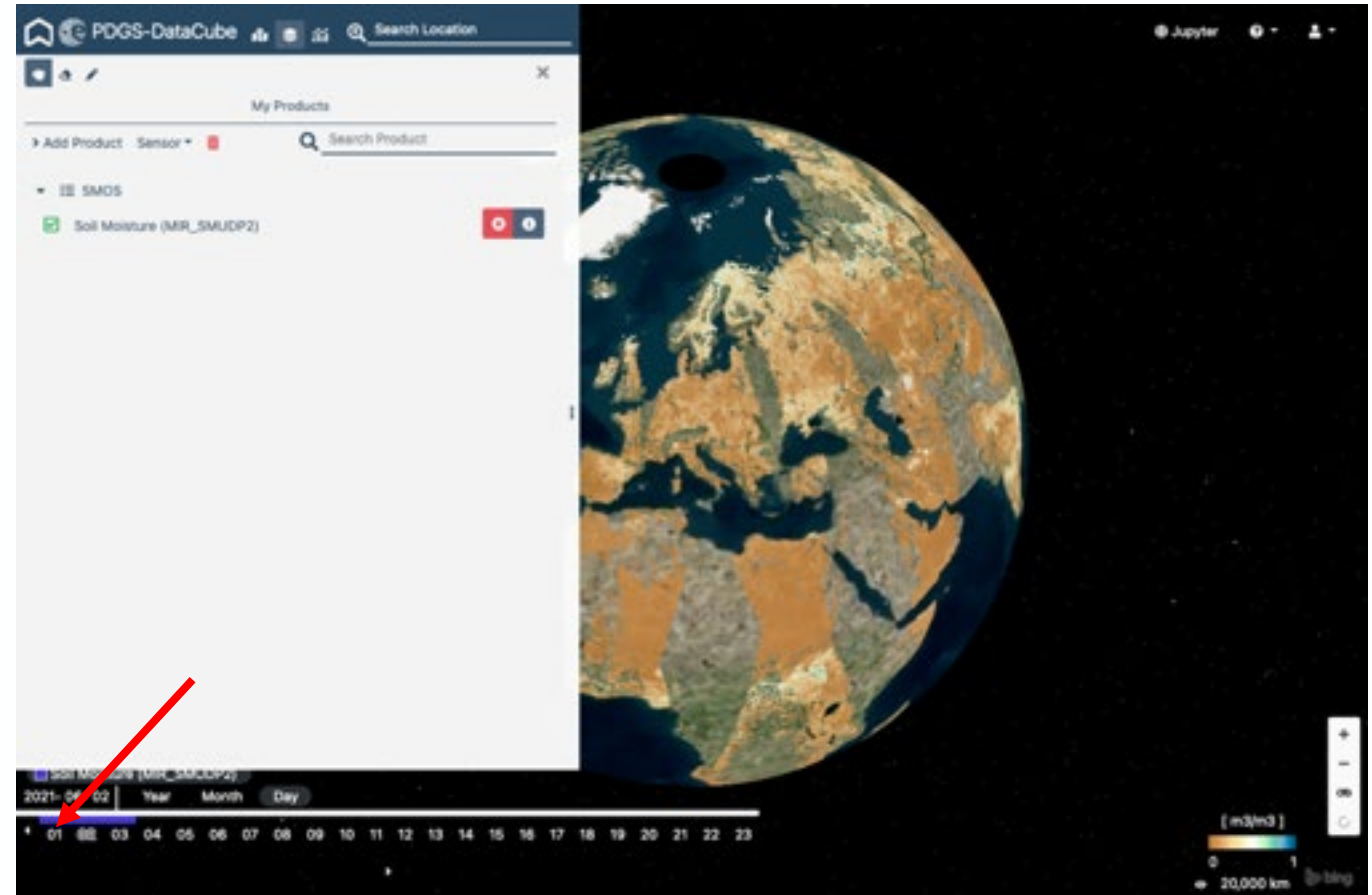
- <https://datacube.pdgs.eo.esa.int>
  - Login



- <https://datacube.pdgs.eo.esa.int>
  - Login
  - **Add Product** to your basket



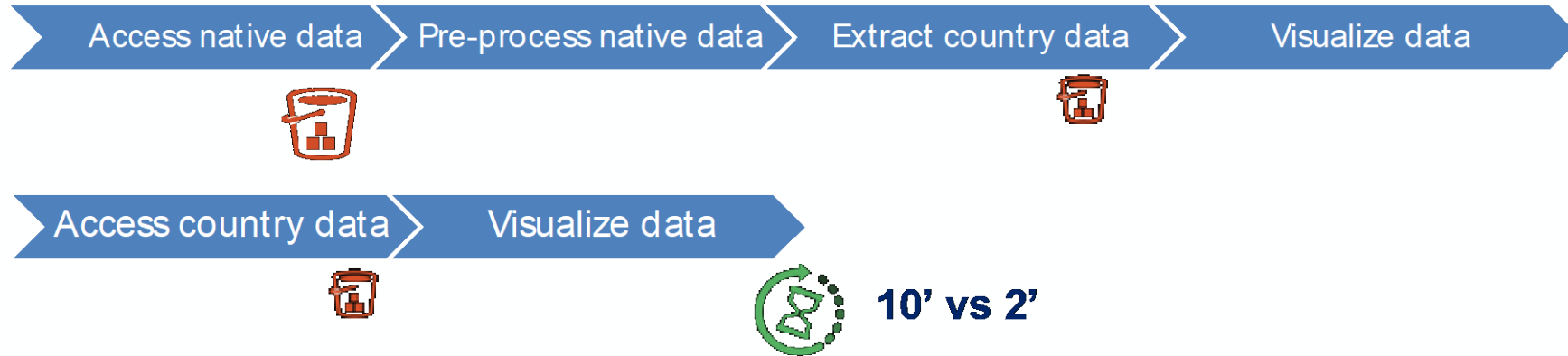
- <https://datacube.pdgs.eo.esa.int>
  - Login
  - Add Product to your basket
  - **Explore**
    - in time



- <https://datacube.pdgs.eo.esa.int>
  - Login
  - Add Product to your basket
  - **Explore**
    - in time
    - in space

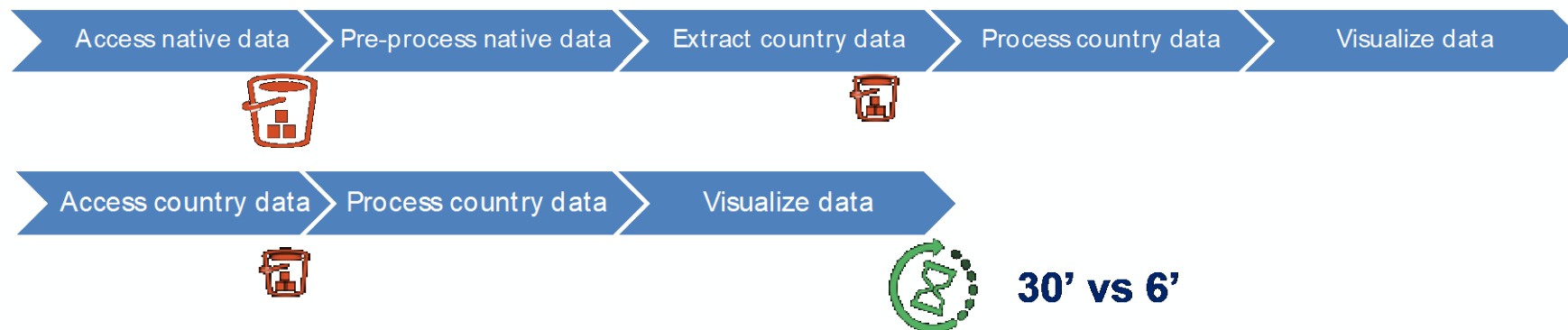


- **How to retrieve time series over your country?**



**Less data → access and processing optimization**

- **How to compute monthly change map over your country?**

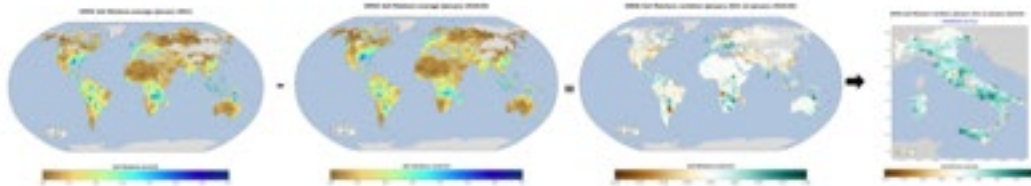




## SMOS Soil Moisture Use Case: traditional approach

### Introduction

The following workflow has been designed to evaluate the variation of the **SMOS Soil Moisture** between the average values of January 2021 and the average of the same months for 2019 and 2020, on a selected spatial subset. In this case the process is implemented with the traditional approach, computing the average values after the extraction of the daily global data and then clipping the results on the Area Of Interest only in the final steps.



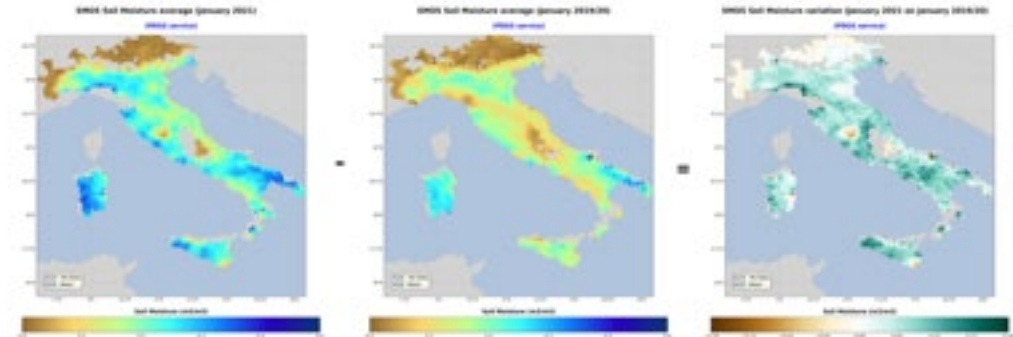
Traditional approach



## SMOS Soil Moisture Use Case: PDGS approach

### Introduction

The following workflow has been designed to evaluate the variation of the **SMOS Soil Moisture** between the average values of January 2021 and the average of the same months for 2019 and 2020, on a selected spatial subset. In this case the process is implemented by exploiting the optimized approach of the **PDGS Datacube** service, that retrieves the monthly average values on the fly and directly on the Area Of Interest.



ESA PDGS Data Cube approach



30' vs 6'

# Q & A

[mantovani@meeo.it](mailto:mantovani@meeo.it)

MEEO S.r.l.

Corso Ercole I d'Este 6/A

44121 - Ferrara (FE), ITALY

