IRIDE S2 Air Quality service

IRIDE Service Segment Lot 1

S2 Exploitation Tool & APIs

User Guide

Updated at April 2024

Stefania Pasetti – MEEO S.r.l, pasetti@meeo.it

Funded by the European Union NextGenerationEU

Content

In the next slides you will find the instructions to:

- Explore the **user interfaces** of the IRIDE S2 service – in SECTION 1
  - S2 Exploitation Tool (ET) (slides from n. 4 to n. 29)
  - Jupyter Notebook (slides from n. 30 to n. 32)
  - S2 Catalogue (slides from n. 33 to n. 42)
  - Use of the WMS link (slides from n. 43 to n. 52)
- Use the IRIDE S2 **available APIs** – in SECTION 2
  (slides from n. 53 to n. 61)

You can follow the instructions written in the yellow boxes reported in the next slides

The current User Guide is available on-line (icon)
https://explorer.iride.adamplatform.eu

Funded by the European Union NextGenerationEU
Italiadomani
esa

IRIDE S2 technological framework

MEEO ADAM - Advanced geospatial DAta Management technology for **transversal use of AQ geospatial products**, based on the **open standard**: OGC® WCS 2.0 -The OGC Web Coverage Service (WCS) access/retrieve geospatial data and OGC® Web Map Service (WMS) for map visualization.

- **Digital Earth concept**, for access to large variety of multi-year global environmental data enabling **visualization, combination, processing and download**
- **Datacubes** to expose **heterogeneous geospatial data (of EO data and modelling data),** for effective subsetting functionalities

ADAM technology organizes the satellite data in order to make them ready to be ingested (**Analysis-Ready Data - ARD**), as input data, by the modelling components and, in general, for end user exploitation, according to their peculiar requirements in terms of format.

Main operations in IRIDE:

- Unzipping, re-projection, re-gridding, format conversion
- Indexing in (web) services (OpenSearch, STAC, WCS)
- Production and visualization of maps and time series graphs

Components:

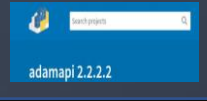
Explorer to support human-friendly data visualization (ET of the S2 Air Quality service)

Slides 4-29

Jupyter Notebook as interactive development environment for data analytics and statistics

Slides 30-32

ADAMAPI for data access, to support M2M data exploitation



Slides 53-61

Funded by the European Union NextGenerationEU
Italiadomani
esa

SECTION 1 – IRIDE S2 User Interface

Please consider that the Exploitation Tool of the S2 Air Quality service can be reached in two ways:

1) With the direct link to the S2 Exploitation Tool (ET)
https://explorer.iride.adamplatform.eu ← *(here the current User Guide is available see the on-line icon)*

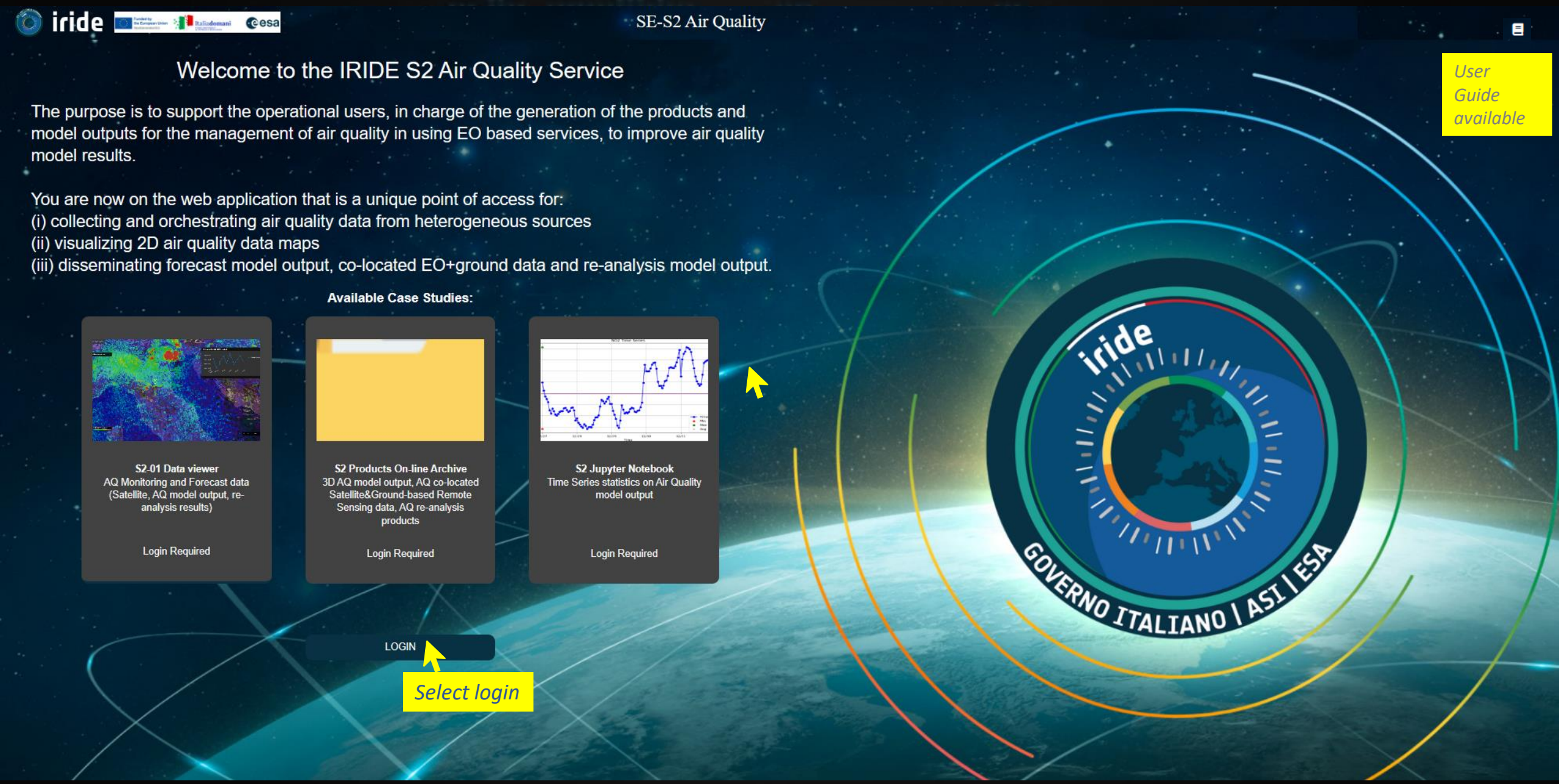
Access the IRIDE ET with the IRIDE SSO account

or

2) Starting from IRIDE Catalogue:
https://dev-portal.irideservices.earth

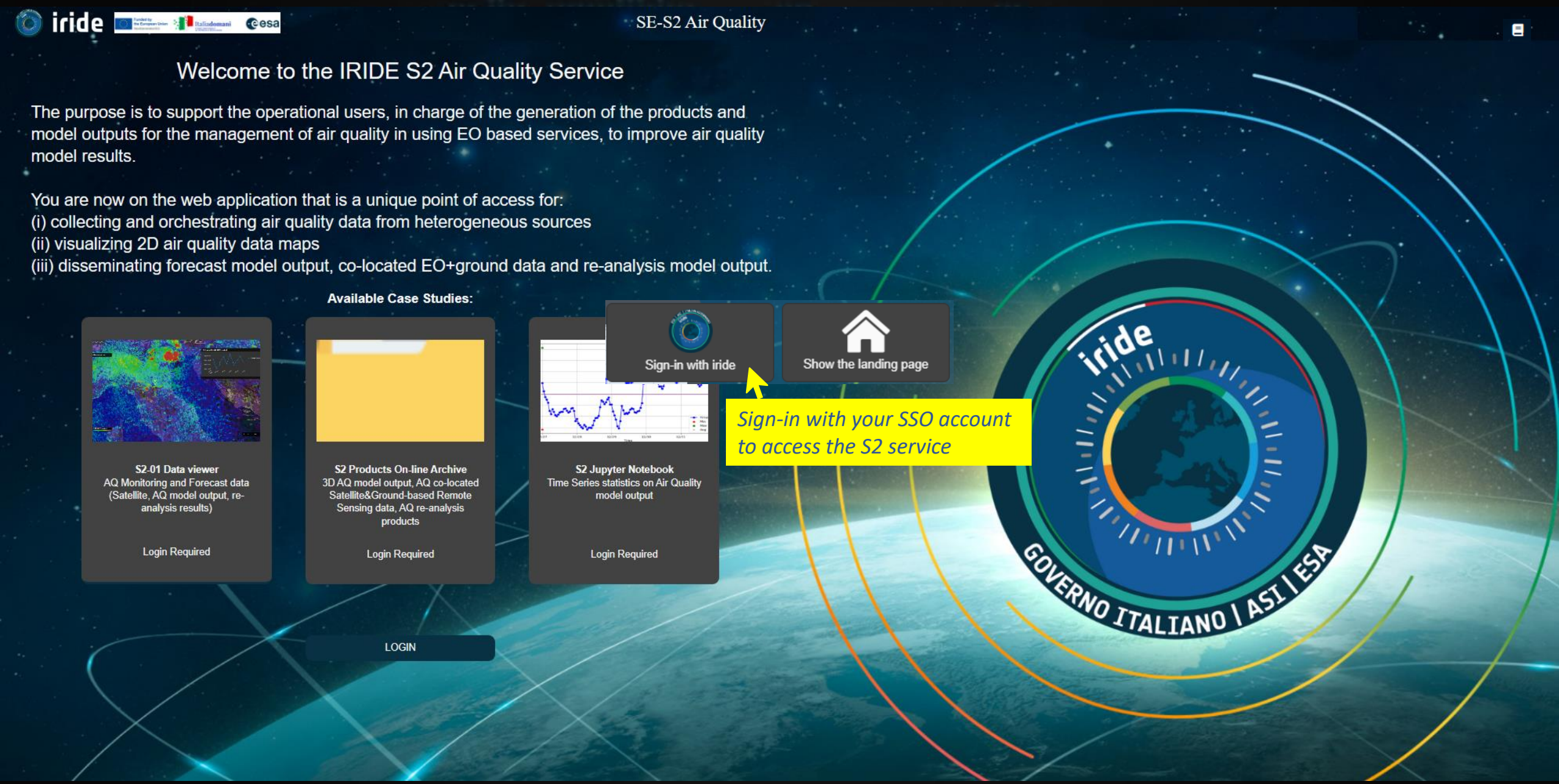
Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01-01 web application

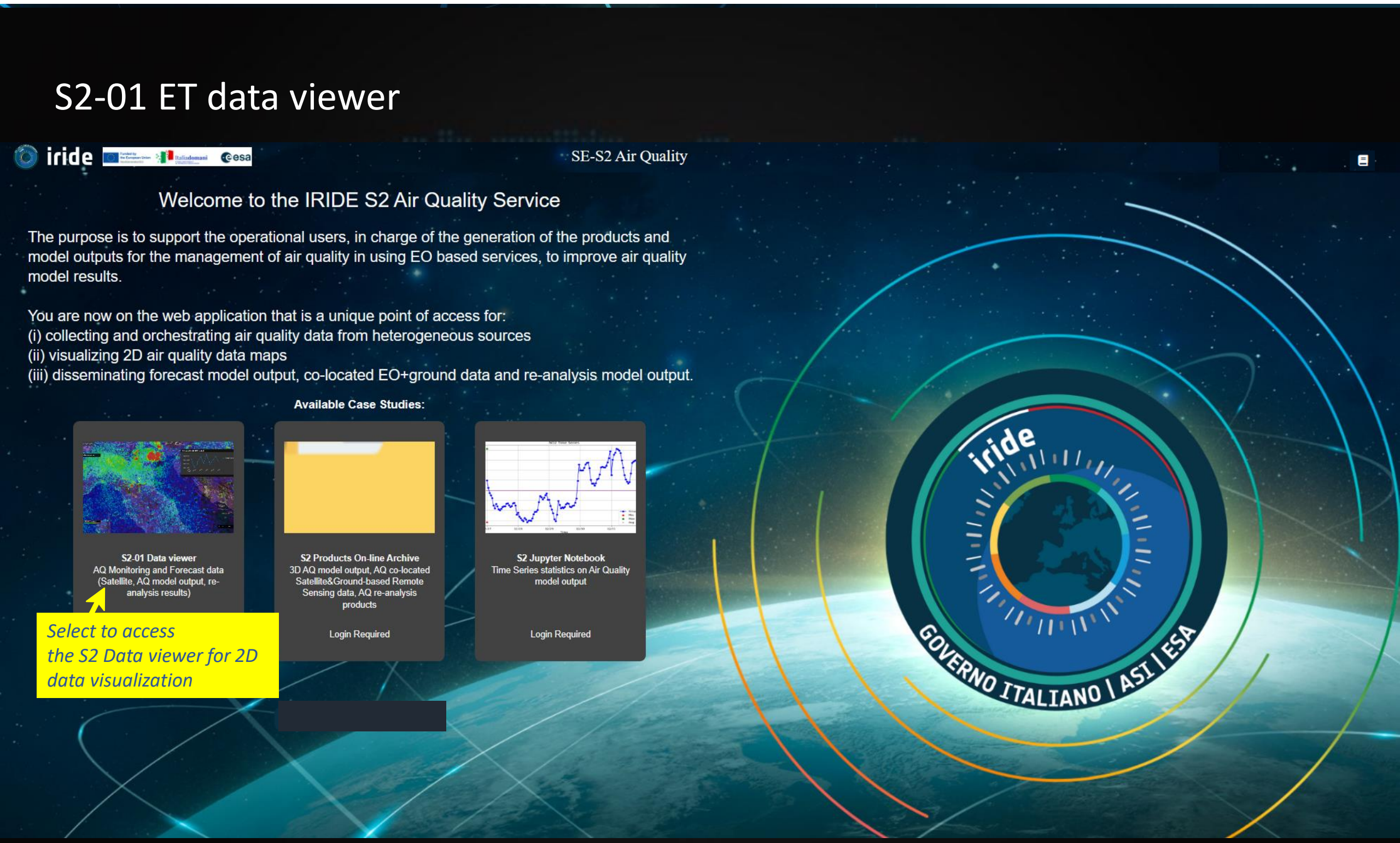


Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01-01 web application

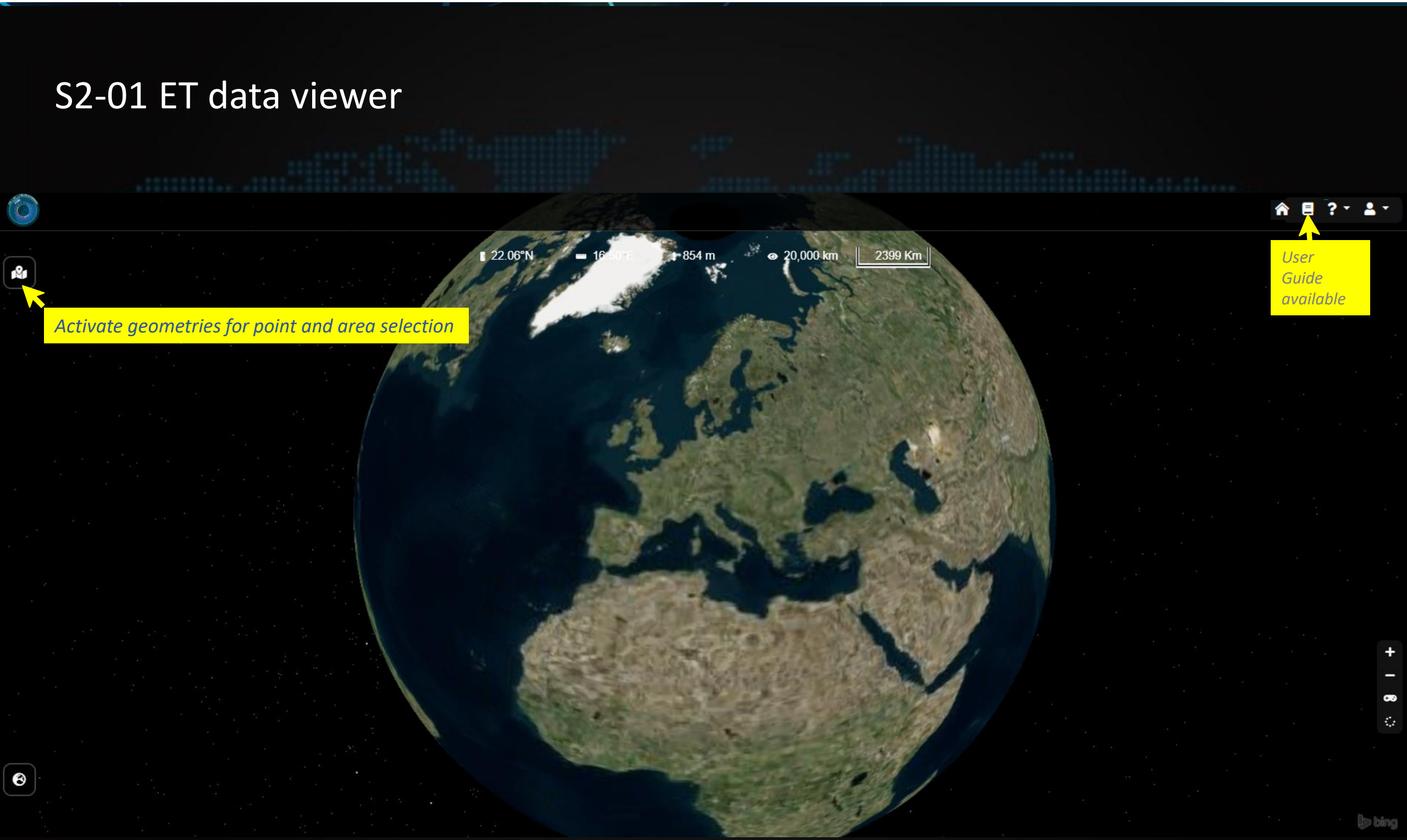


S2-01 ET data viewer



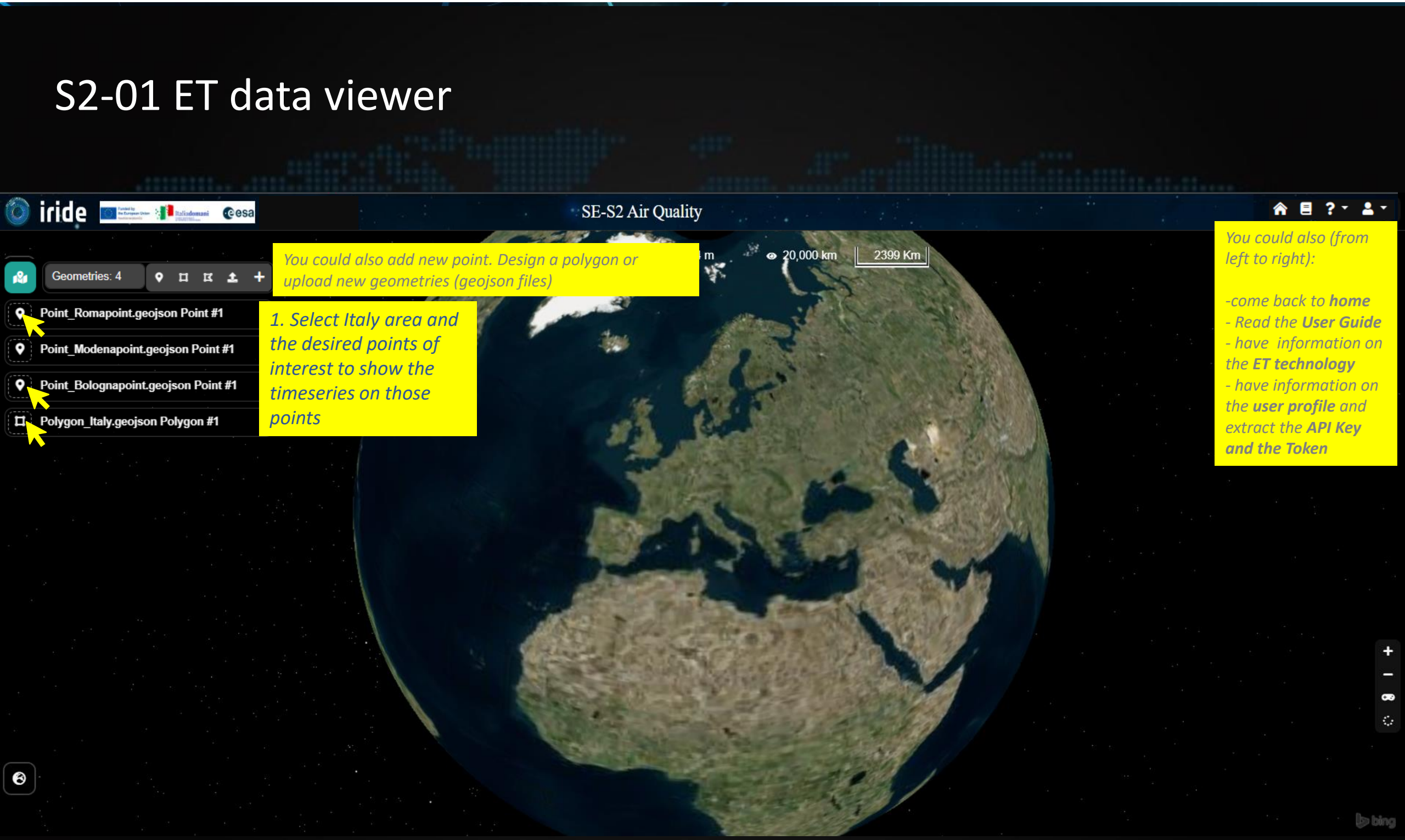
Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET data viewer



Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET data viewer

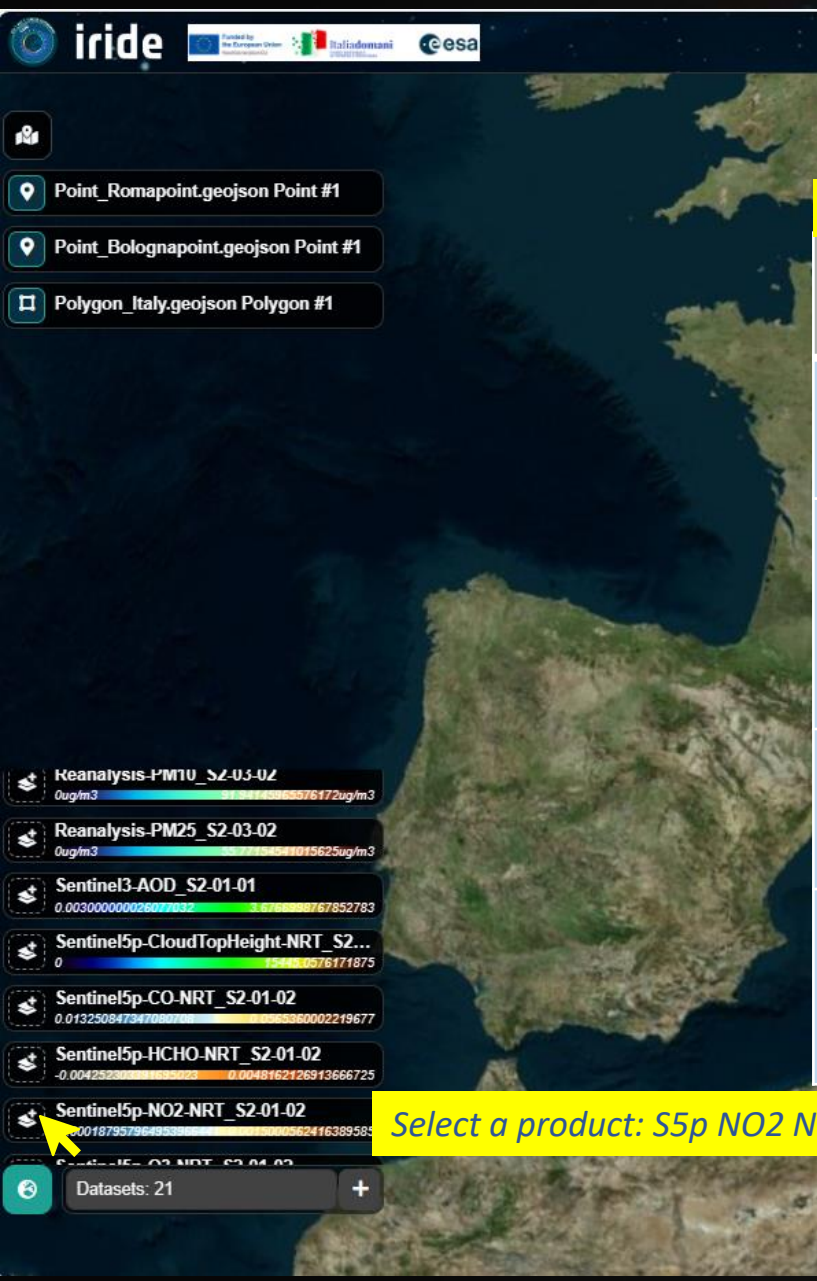


Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET data viewer

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET data viewer: S2-01-02 Sentinel 5p NO2 (NRT)



Available products on the Data Viewer

Product name	Dataset name on the ET Data viewer **To visualize and download 2D data** **(.COG for maps and .csv for time series)**
S2-01-01: S3-Satellite air quality data (EO ARD) From **Sentinel 3**, not available on the Sentinel hub EO data sources as ARD.	Sentinel3-AOD _S2-01-01 (it includes historical and NRT data)
S2-01-02: S5p-Satellite air quality data (ARD) (from **Sentinel 5p**, not available on the Sentinel hub EO data sources as ARD)	Sentinel5p-O3-NRT_S2-01-02 / Sentinel5p-O3-OFFL_S2-01-02 Sentinel5p-CO-NRT_S2-01-02 / Sentinel5p-CO-OFFL_S2-01-02 Sentinel5p-HCHO-NRT_S2-01-02 / Sentinel5p-HCHO-OFFL_S2-01-02 Sentinel5p-NO2-NRT_S2-01-02 / Sentinel5p-NO2-OFFL_S2-01-02 Sentinel5p-SO2-NRT_S2-01-02 / Sentinel5p-SO2-OFFL_S2-01-02 Sentinel5p-cloudTopHeight-NRT_S2-01-02 / Sentinel5p-cloudTopHeight-OFFL_S2-01-02
kAIROS **AQ forecast models** visualization of 2D data and access to 2D and 3D data	2D data: kAIROS-model-PM10_S2-01-03 kAIROS-model-PM25_S2-01-03 kAIROS-model-NO2_S2-01-03
SVC-03 output (**re-analysis products**) visualization and dissemination	**S2-03-01**: Reanalysis-AQI_S2-03-01 Reanalysis-NO2_S2-03-01 Reanalysis-O3_S2-03-01 **S2-03-02**: Reanalysis-PM10_S2-03-02 Reanalysis-PM25_S2-03-02

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET data viewer: S2-01-02 Sentinel 5p NO2 (NRT)

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET data viewer: S2-01-02 Sentinel 5p NO2 (NRT)

S2-01 ET data viewer: S2-01-02 Sentinel 5p NO2 (NRT)

Systematic product (NRT) over Italy, daily update.

Here the zoomed-in the time series on Rome point

1. Download the .csv of the time series of the last 10 days

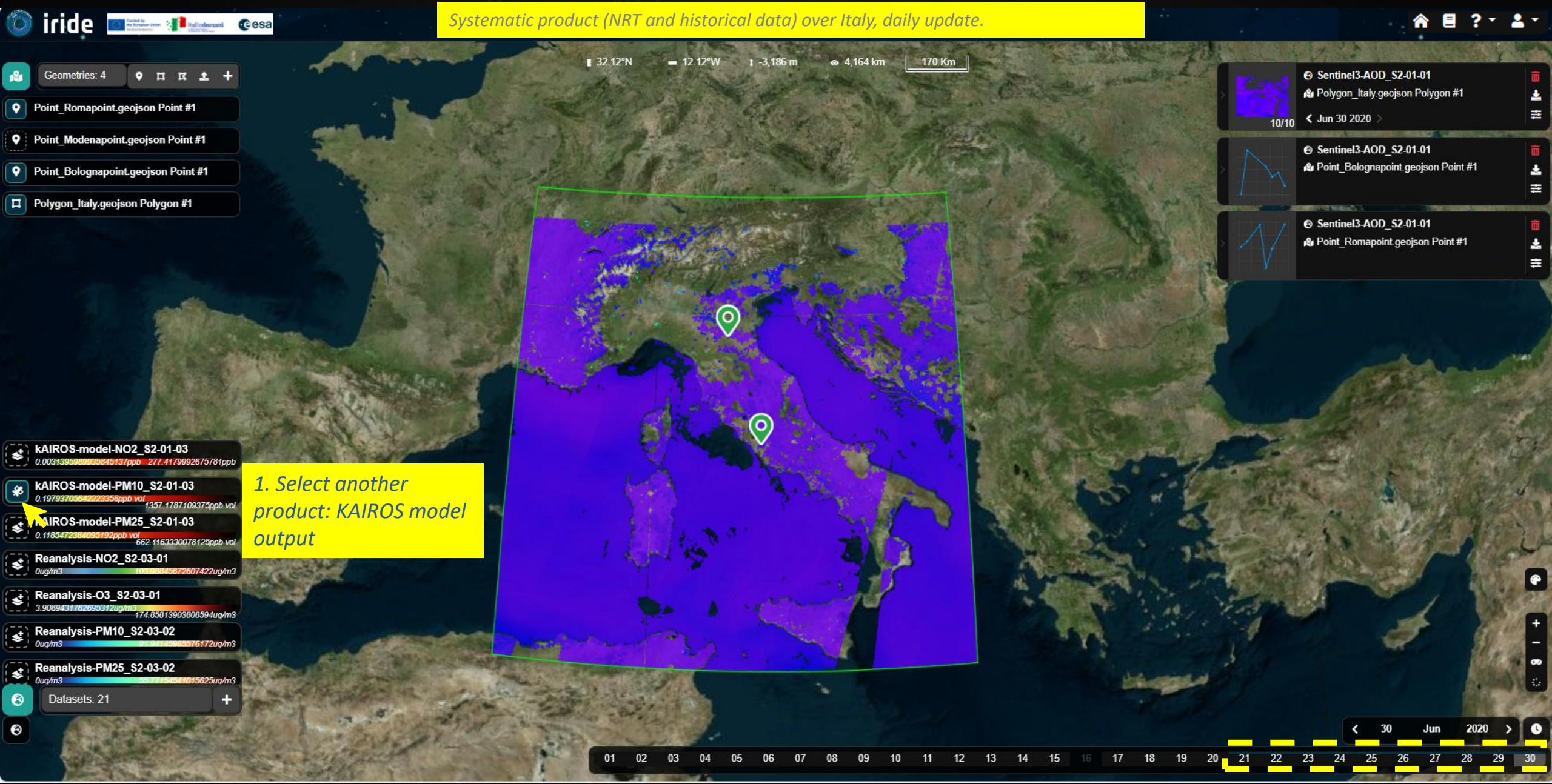
2. De-select the current product (or keep it selected if you want to overlap it with another map)

3. Select another product

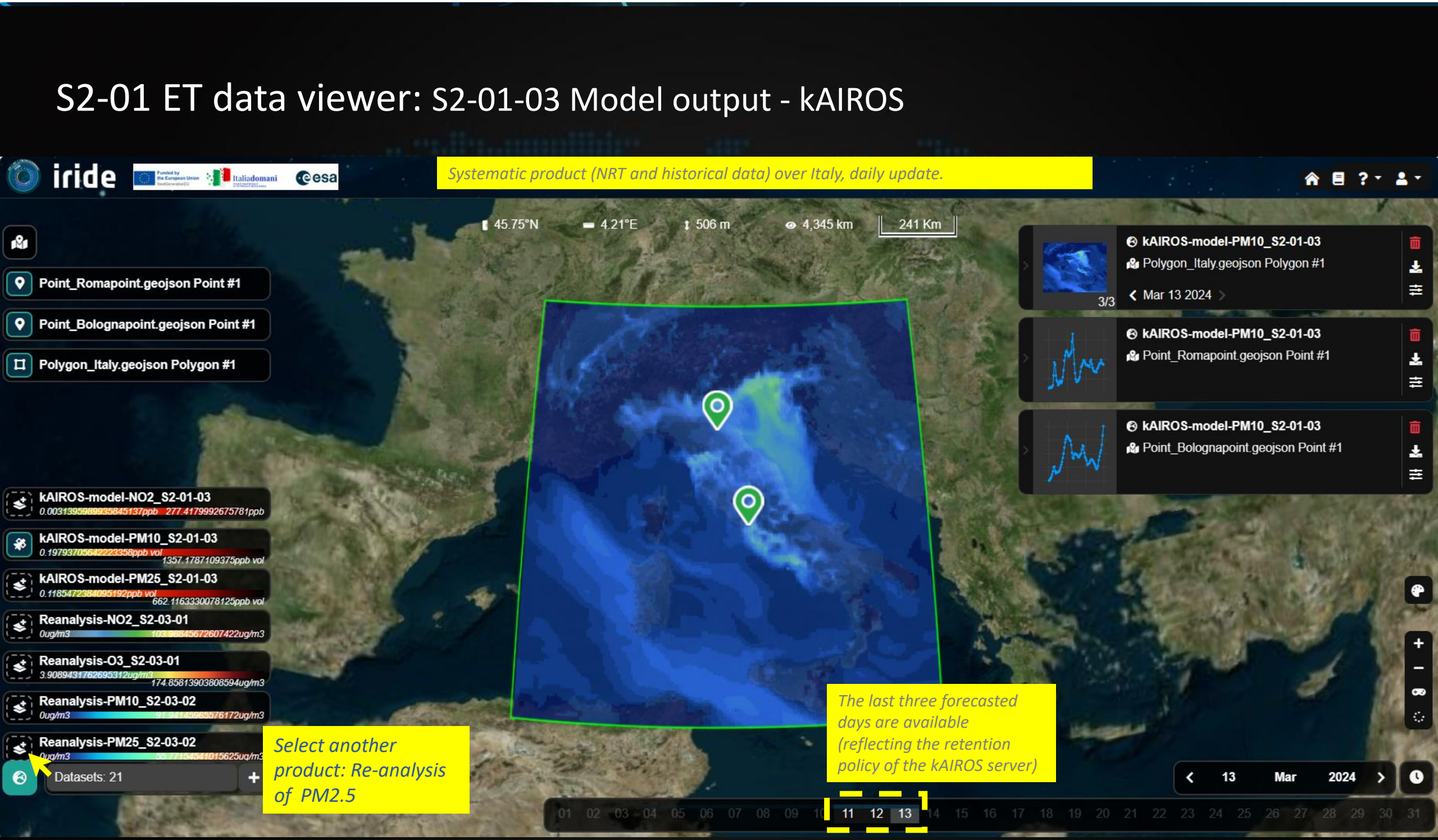
1	Point_Romapoint.geojson Point #1,"{'type': 'Point', 'coordinates': [
2	2024-03-02T11:27:48Z,0.00010758119606180117,
3	2024-03-02T11:32:48Z,0.0001075804975698702,
4	2024-03-02T13:12:48Z,5.12790575157851e-05,
5	2024-03-03T11:12:48Z,5.719166074413806e-05,
6	2024-03-03T12:52:48Z,5.978146873530932e-05,
7	2024-03-04T12:32:48Z,9.970846440410241e-05,
8	2024-03-05T12:12:48Z,0.0001664527808316052,
9	2024-03-06T11:52:48Z,7.000456389505416e-05,
10	2024-03-06T11:57:48Z,7.000520417932421e-05,
11	2024-03-07T11:37:48Z,9.909152140608057e-05,
12	2024-03-08T11:17:48Z,0.00011094669753219932,
13	2024-03-08T12:57:48Z,7.939992065075785e-05,
14	2024-03-09T10:57:48Z,0.0001042018920998089,
15	2024-03-09T12:37:48Z,8.076847734628245e-05,
16	2024-03-10T12:17:48Z,7.774506229907274e-05,
17	2024-03-10T12:22:48Z,7.774453843012452e-05,
18	2024-03-11T12:02:48Z,8.21558351162821e-05,

S2-01 ET data viewer: S2-01-01 Sentinel 3 AOD

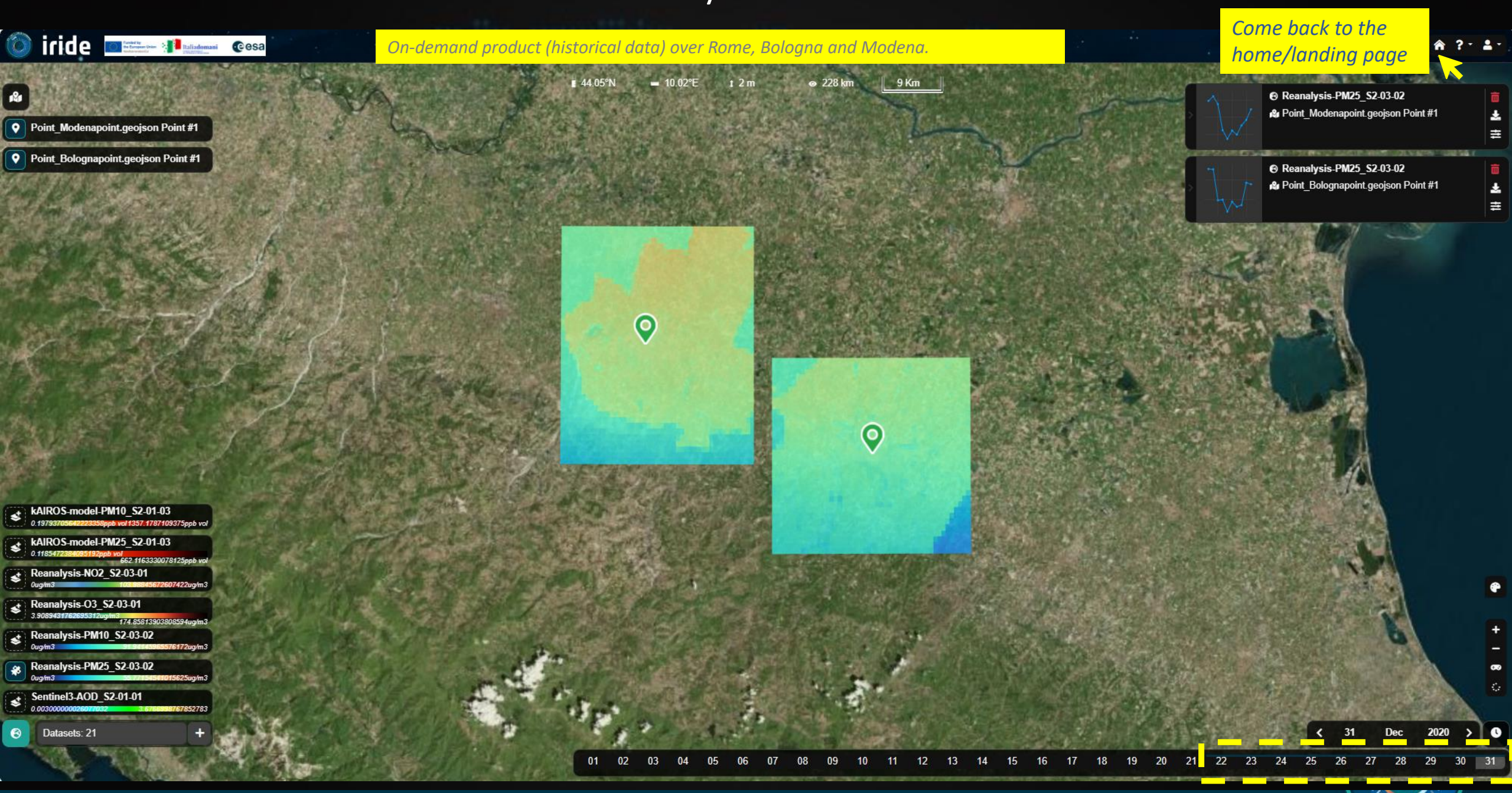
Systematic product (NRT and historical data) over Italy, daily update.



S2-01 ET data viewer: S2-01-03 Model output - kAIROS



S2-01 ET data viewer: S2-01-03 Reanalysis-PM25



Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET for on-line archive data access

iride

SE-S2 Air Quality

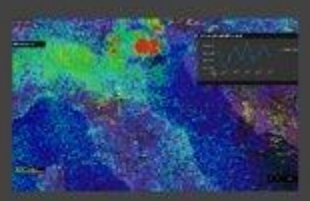
Welcome to the IRIDE S2 Air Quality Service

The purpose is to support the operational users, in charge of the generation of the products and model outputs for the management of air quality in using EO based services, to improve air quality model results.

You are now on the web application that is a unique point of access for:
(i) collecting and orchestrating air quality data from heterogeneous sources
(ii) visualizing 2D air quality data maps
(iii) disseminating forecast model output, co-located EO+ground data and re-analysis model output.

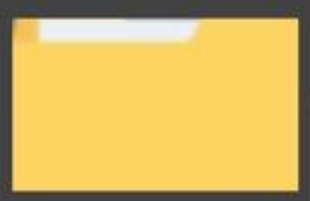
User Guide available

Available Case Studies:



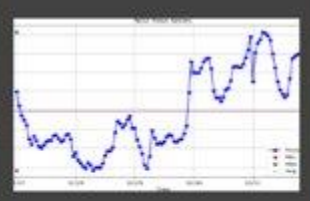
S2-01 Data viewer
AQ Monitoring and Forecast data (Satellite, AQ model output, re-analysis results)

No Login Required



S2 Products On-line Archive
3D AQ model output, AQ co-located Satellite&Ground-based Remote Sensing data, AQ re-analysis products

Login Required



S2 Jupyter Notebook
Time Series statistics on Air Quality model output

Login Required

Select the On-line archive to access the other data (3D data and .nc)

Funded by the European Union NextGenerationEU
Italiadomani
esa

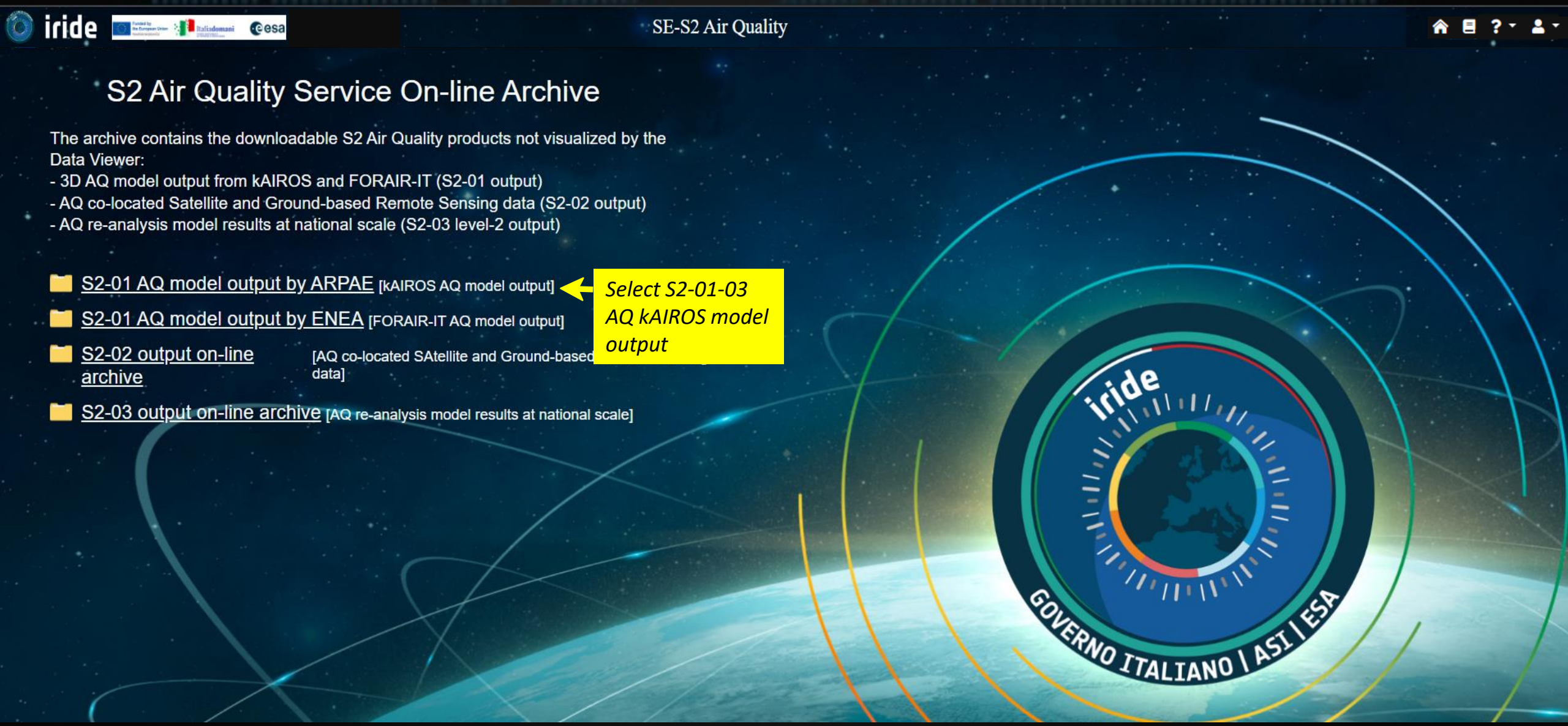
S2-01 ET for on-line archive data access

Available products on the On-line archive

Product name	Files on the ET on-line archive/ftp server To access and download 3D data and .nc files (.nc, .tif, .geojson)
S2-01 AQ model output by ARPAE/SNPA kAIROS **AQ forecast models** visualization of 2D data and access to 2D and 3D data	2D NRT and historical (3D data till 3 Nov 2023): /ftp/ARPAE/NRT/ (last forecasted 3 days) /ftp/ARPAE/asi-ispra-qa.datamb.it/ (2019/2020)
S2-01 AQ model output by ENEA FORAIR-IT **AQ forecast models** Access to 3D data	3D NRT data: /ftp/ENEA/3D (last forecasted 3 days)
SVC-02 output (**co-located EO+ground data**) Access to data (structured as 3D data)	NRT and historical data (**S2-02-01** for PM10 and PM2.5, **S2-02-02** for NO2, O3, CO, HCHO, SO2): /ftp/SERCO/Historical_data_S2-02/ /ftp/SERCO/NRT_S2-02/
SVC-03 output (**re-analysis products**) visualization and dissemination	Historical data: /ftp/ST/Combined-trace-gases-reanalysis_**S2-03-01**/ /ftp/ST/Combined-PM-reanalysis_**S2-03-02**/

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET for on-line archive data access



Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 AQ kAIROS 3D model output

3. Use the BACK button of the toolbar of your browser to come back to the On-line archive home page

https://explorer.iride.adamplatform.eu/?use_case=2

Index of /ftp/ARPAE/

../		
2D/	02-Nov-2023 16:40	-
3D/	03-Nov-2023 16:31	-

1. access the S2-01 3D Arpae model output

Index of /ftp/ARPAE/3D/

../		
out_d0_NORD_2023-11-02.nc	03-Nov-2023 16:13	0
out_d0_NORD_2023-11-03.nc	03-Nov-2023 05:21	3576452080
out_d1_NORD_2023-11-02.nc	03-Nov-2023 16:13	0
out_d1_NORD_2023-11-03.nc	03-Nov-2023 05:21	3576452080
out_d2_NORD_2023-11-03.nc	03-Nov-2023 05:21	3576452080

2. Download the .nc file by selecting one of it

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET for on-line archive data access

iride

S2 Air Quality Service On-line Archive

The archive contains the downloadable S2 Air Quality products not visualized by the Data Viewer:
- 3D AQ model output from kAIROS and FORAIR-IT (S2-01 output)
- AQ co-located Satellite and Ground-based Remote Sensing data (S2-02 output)
- AQ re-analysis model results at national scale (S2-03 level-2 output)

- S2-01 AQ model output by ARPAE [kAIROS AQ model output]
- S2-01 AQ model output by ENEA [FORAIR-IT AQ model output]
- S2-02 output on-line archive [AQ co-located SAtellite and Ground-based Remote Sensing data]
- S2-03 output on-line archive [AQ re-analysis model results at national scale]

Select S2-01-03 AQ FORAIR-IT model output

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 AQ FORAIR-IT 3D model output

3. Use the BACK button of the toolbar of your browser to come back to the On-line archive home page

https://explorer.iride.adamplatform.eu/?use_case=2

Index of /ftp/ENEA/

../
3D/ 22-Nov-2023 13:08 -

1. access the S2-01 3D ENEA model output

Index of /ftp/ENEA/3D/

../		
FARM_conc_g2_20231120_D1.nc	22-Nov-2023 12:47	12948511943
FARM_conc_g2_20231120_D2.nc	22-Nov-2023 13:08	12948511943
FARM_conc_g2_20231120_D3.nc	22-Nov-2023 13:18	12948511943
FARM_conc_g2_20231121_D3.nc	22-Nov-2023 12:33	12948511943
FARM_conc_g2_20231122_D1.nc	22-Nov-2023 10:24	12948511943
FARM_conc_g2_20231122_D2.nc	22-Nov-2023 10:39	12948511943
FARM_conc_g2_20231122_D3.nc	22-Nov-2023 10:59	12948511943

2. download the .nc file by selecting one of it

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET for on-line archive data access

iride

S2 Air Quality Service On-line Archive

The archive contains the downloadable S2 Air Quality products not visualized by the Data Viewer:
- 3D AQ model output from kAIROS and FORAIR-IT (S2-01 output)
- AQ co-located Satellite and Ground-based Remote Sensing data (S2-02 output)
- AQ re-analysis model results at national scale (S2-03 level-2 output)

- S2-01 AQ model output by ARPAE [kAIROS AQ model output]
- S2-01 AQ model output by ENEA [FORAIR-IT AQ model output]
- S2-02 output on-line archive [AQ co-located SAtellite and Ground-based Remote Sensing data]
- S2-03 output on-line archive [AQ re-analysis model results at national scale]

Select S2-02 output folder for co-located EO and Ground based remote sensing data

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-02 output

Index of /ftp/SERCO/

../
Historical data S2-02/ 28-Feb-2024 15:29 -
NRT_S2-02/ 28-Feb-2024 14:58 -

1

Index of /ftp/SERCO/NRT_S2-02/

../
AOD-satellite and groundbased S2-02-01/ 28-Feb-2024 14:57 -
Pollutants-satellite and groundbased S2-02-02/ 28-Feb-2024 14:58 -

2

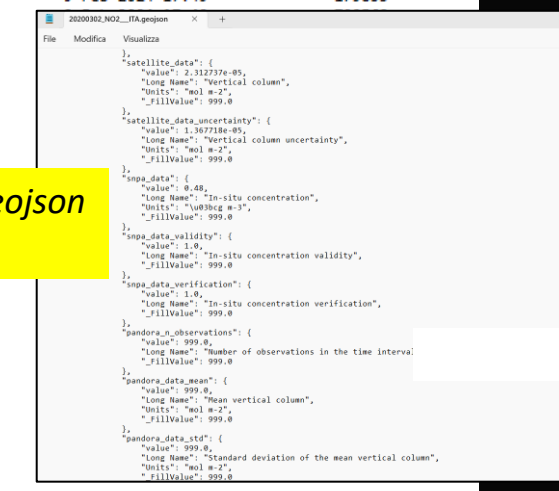
Index of /ftp/SERCO/NRT_S2-02/Pollutants-satellite_and_groundbased_S2-02-02/

../
CO-sat-gb_S2-02-02/ 07-Mar-2024 10:00 -
HCHO-sat-gb_S2-02-02/ 07-Mar-2024 10:08 -
NO2-sat-gb_S2-02-02/ 07-Mar-2024 13:39 -
O3-sat-gb_S2-02-02/ 07-Mar-2024 10:04 -
SO2-sat-gb_S2-02-02/ 07-Mar-2024 10:06 -

3

../
NO2-sat-gb-20240201_S2-02-02.geojson 29-Feb-2024 17:49 1628344
NO2-sat-gb-20240201_S2-02-02.nc 29-Feb-2024 17:49 200689
NO2-sat-gb-20240202_S2-02-02.geojson 29-Feb-2024 17:49 2207926
NO2-sat-gb-20240202_S2-02-02.nc 29-Feb-2024 17:49 258153
NO2-sat-gb-20240203_S2-02-02.geojson 29-Feb-2024 17:49 2243435
NO2-sat-gb-20240203_S2-02-02.nc 29-Feb-2024 17:49 259665
NO2-sat-gb-20240204_S2-02-02.geojson 29-Feb-2024 17:49 2326313
NO2-sat-gb-20240204_S2-02-02.nc 29-Feb-2024 17:49 267289
NO2-sat-gb-20240205_S2-02-02.geojson 29-Feb-2024 17:49 3520874
NO2-sat-gb-20240205_S2-02-02.nc 29-Feb-2024 17:49 404209
NO2-sat-gb-20240206_S2-02-02.geojson 29-Feb-2024 17:49 2093727
NO2-sat-gb-20240206_S2-02-02.nc 29-Feb-2024 17:49 253281
NO2-sat-gb-20240207_S2-02-02.geojson 29-Feb-2024 17:49 1738811
NO2-sat-gb-20240207_S2-02-02.nc 29-Feb-2024 17:49 209489
NO2-sat-gb-20240208_S2-02-02.geojson 29-Feb-2024 17:49 1538052
NO2-sat-gb-20240208_S2-02-02.nc 29-Feb-2024 17:49 180441
NO2-sat-gb-20240209_S2-02-02.geojson 29-Feb-2024 17:49 635148
NO2-sat-gb-20240209_S2-02-02.nc 29-Feb-2024 17:49 94801
NO2-sat-gb-20240210_S2-02-02.geojson 29-Feb-2024 17:49 134293
NO2-sat-gb-20240210_S2-02-02.nc 29-Feb-2024 17:49 29685
NO2-sat-gb-20240211_S2-02-02.geojson 29-Feb-2024 17:49 2061882
NO2-sat-gb-20240211_S2-02-02.nc 29-Feb-2024 17:49 235553
NO2-sat-gb-20240212_S2-02-02.geojson 29-Feb-2024 17:49 2066184
NO2-sat-gb-20240212_S2-02-02.nc 29-Feb-2024 17:49 235721
NO2-sat-gb-20240213_S2-02-02.geojson 29-Feb-2024 17:49 1979274
NO2-sat-gb-20240213_S2-02-02.nc 29-Feb-2024 17:49 232025
NO2-sat-gb-20240214_S2-02-02.geojson 29-Feb-2024 17:49 2136824
NO2-sat-gb-20240214_S2-02-02.nc 29-Feb-2024 17:49 246937
[illegible] 29-Feb-2024 17:49 2444738
[illegible] 9-Feb-2024 17:49 276425
[illegible] 9-Feb-2024 17:49 71272
[illegible] 9-Feb-2024 17:49 24280
[illegible] 9-Feb-2024 17:49 2452333
[illegible] 9-Feb-2024 17:49 280857
[illegible] 9-Feb-2024 17:49 1813820
[illegible] 9-Feb-2024 17:49 216777
[illegible] 9-Feb-2024 17:49 2054273
[illegible] 9-Feb-2024 17:49 235217
[illegible] 9-Feb-2024 17:49 2637649
[illegible] 9-Feb-2024 17:49 325617
[illegible] 9-Feb-2024 17:49 3327679
[illegible] 9-Feb-2024 17:49 391881
[illegible] 9-Feb-2024 17:49 1427689
[illegible] 9-Feb-2024 17:49 179833
NO2-sat-gb-20240224_S2-02-02.geojson
NO2-sat-gb-20240224_S2-02-02.nc
NO2-sat-gb-20240225_S2-02-02.geojson
NO2-sat-gb-20240225_S2-02-02.nc
NO2-sat-gb-20240227_S2-02-02.geojson
NO2-sat-gb-20240227_S2-02-02.nc
NO2-sat-gb-20240302_S2-02-02.geojson
NO2-sat-gb-20240302_S2-02-02.nc
NO2-sat-gb-20240303_S2-02-02.geojson
NO2-sat-gb-20240303_S2-02-02.nc
NO2-sat-gb-20240304_S2-02-02.geojson
NO2-sat-gb-20240304_S2-02-02.nc
NO2-sat-gb-20240305_S2-02-02.geojson
NO2-sat-gb-20240305_S2-02-02.nc
NO2-sat-gb-20240306_S2-02-02.geojson
NO2-sat-gb-20240306_S2-02-02.nc

4. Download the .nc or .geojson file by selecting one of it



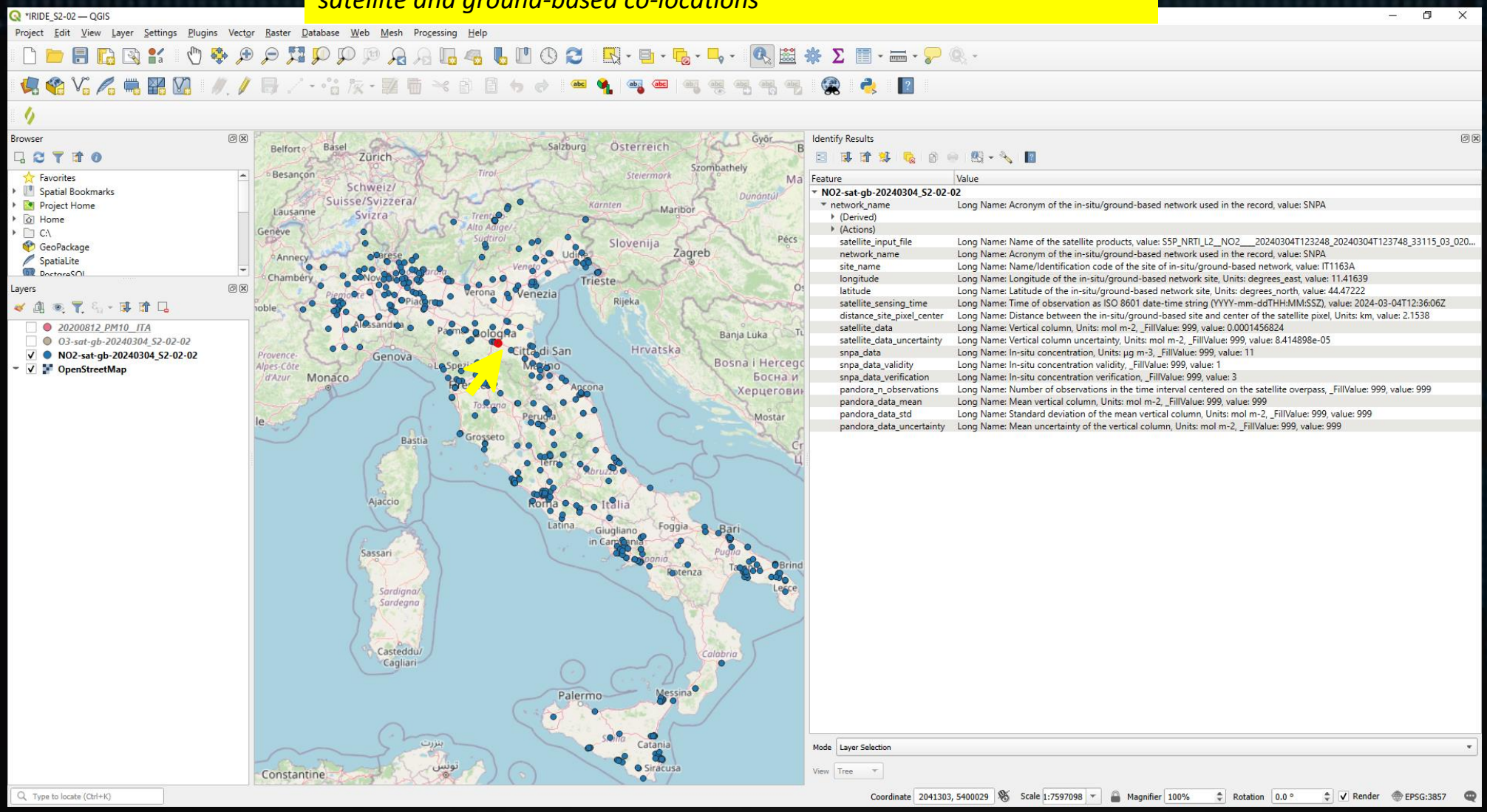
5. Use the BACK button of the toolbar of your browser to come back to the On-line archive home page

https://explorer.iride.adamplatform.eu/?use_case=2

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-02 output

Open the downloaded product using QGIS and navigate through different satellite and ground-based co-locations



Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01 ET for on-line archive data access

iride

S2 Air Quality Service On-line Archive

The archive contains the downloadable S2 Air Quality products not visualized by the Data Viewer:
- 3D AQ model output from kAIROS and FORAIR-IT (S2-01 output)
- AQ co-located Satellite and Ground-based Remote Sensing data (S2-02 output)
- AQ re-analysis model results at national scale (S2-03 level-2 output)

- S2-01 AQ model output by ARPAE [kAIROS AQ model output]
- S2-01 AQ model output by ENEA [FORAIR-IT AQ model output]
- S2-02 output on-line archive [AQ co-located SAtellite and Ground-based Remote Sensing data]
- S2-03 output on-line archive [AQ re-analysis model results at national scale]

Select S2-03 folder output for re-analysed product

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-03 re-analysis output

Index of /ftp/ST/

../
Combined-PM-reanalysis_S2-03-02/ 28-Feb-2024 15:32 -
Combined-trace-gases-reanalysis_S2-03-01/ 28-Feb-2024 15:34 -

1

Index of /ftp/ST/Combined-trace-gases-reanalysis_S2-03-01/

../
Reanalysis-AQI_S2-03-01/ 28-Feb-2024 15:41 -
Reanalysis-NO2_S2-03-01/ 28-Feb-2024 15:41 -
Reanalysis-O3_S2-03-01/ 28-Feb-2024 15:41 -

2

Index of /ftp/ST/Combined-trace-gases-reanalysis_S2-03-01/Reanalysis-NO2_S2-03-01/

../
Reanalysis-NO2_S2-03-01_nc/ 29-Feb-2024 10:24 -
Reanalysis-NO2_S2-03-01_tif/ 29-Feb-2024 09:41 -

3

Index of /ftp/ST/Combined-trace-gases-reanalysis_S2-03-01/Reanalysis-NO2_S2-03-01/Reanalysis-NO2_S2-03-01_nc/

../
2018/ 29-Feb-2024 10:24 -
2019/ 29-Feb-2024 10:24 -

4

Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-03 re-analysis output

Index of /ftp/ST/Combined-trace-gases-reanalysis_S2-03-01/Reanalysis-NO2_S2-03-01/Reanalysis-NO2_S2-03-01_nc/

../
2018/ 29-Feb-2024 10:24 -
2019/ 29-Feb-2024 10:24 -

1

Index of /ftp/ST/Combined-trace-gases-reanalysis_S2-03-01/Reanalysis-NO2_S2-03-01/Reanalysis-NO2_S2-03-01_nc/2018/

../
01/ 29-Feb-2024 10:24 -
02/ 29-Feb-2024 10:24 -
03/ 29-Feb-2024 10:24 -
04/ 29-Feb-2024 10:24 -
05/ 29-Feb-2024 10:24 -
06/ 29-Feb-2024 10:24 -
07/ 29-Feb-2024 10:24 -
08/ 29-Feb-2024 10:24 -
09/ 29-Feb-2024 10:24 -
10/ 29-Feb-2024 10:24 -
11/ 29-Feb-2024 10:24 -
12/ 29-Feb-2024 10:24 -

2

Index of /ftp/ST/Combined-trace-gases-reanalysis_S2-03-01/Reanalysis-NO2_S2-03-01/Reanalysis-NO2_S2-03-01_nc/2018/09/

../
01/ 29-Feb-2024 10:24 -
02/ 29-Feb-2024 10:24 -
03/ 29-Feb-2024 10:24 -
04/ 29-Feb-2024 10:24 -
05/ 29-Feb-2024 10:24 -
06/ 29-Feb-2024 10:24 -
07/ 29-Feb-2024 10:24 -
08/ 29-Feb-2024 10:24 -
09/ 29-Feb-2024 10:24 -
10/ 29-Feb-2024 10:24 -
11/ 29-Feb-2024 10:24 -
12/ 29-Feb-2024 10:24 -
13/ 29-Feb-2024 10:24 -
14/
15/
16/
17/
18/
19/
20/
21/ 29-Feb-2024 10:24 -
22/
23/
24/
25/
26/
27/
28/
29/
30/

3

5. Use the BACK button of the toolbar of your browser to come back to the On-line archive home page

https://explorer.iride.adamplatform.eu/?use_case=2

Index of /ftp/ST/Combined-trace-gases-reanalysis_S2-03-01/Reanalysis-NO2_S2-03-01/Reanalysis-NO2_S2-03-01_nc/2018/09/18/

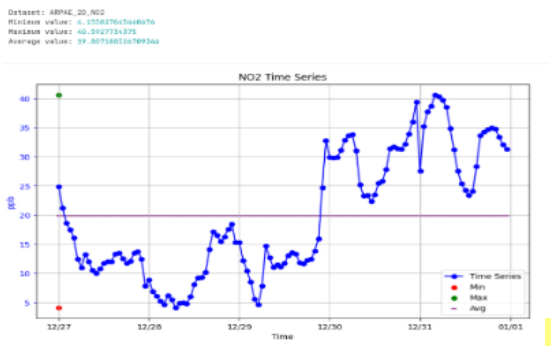
4. Download the .nc file by selecting one of it

../
processed-no2_roma_20180918000000_2018091823000..> 29-Feb-2024 10:24 589128

OU-S2-01-01 web application for time series statistics

Funded by the European Union NextGenerationEU
Italiadomani
esa

OU-S2-01-01 web application for time series statistics (implemented for kAIROS products)



Time Series statistics on Air Quality model output

PUBLISHER: NOEMI FAZZINI

This Notebook allows statistics on single point time series and the plot visualization for a specific dataset in the Adam catalogue. It extracts minimum, maximum and average values from a time series

TAGS:

AIR QUALITY ATMOSPHERE IRIDE LOT.1 S2 - AIR QUALITY AIR QUALITY ARPAE NO2 PM10 PM25

Open on GitHub

Go to GitHub to download and use the code

Tutorial page of the Jupyter Notebook implemented for statistics on time series

Time Series statistics on Air Quality model output

How to compute statistics (minimum, maximum and average) on single point time series and the plot visualization for a specific dataset in the Adam catalogue, in this case applied to the Air Quality model output provided by ARPAE, by using searching and filtering functionalities provided through the API.

Introduction

This notebook shows how to implement an advanced search operation for a specific dataset, by using the functionalities provided in the Adam API, by defining

Funded by the European Union NextGenerationEU
Italiadomani
esa

OU-S2-01-01 web application for time series statistics

Product Solutions Open Source Pricing Search or jump to... / Sign in Sign up

marcofole / notebooks Public

Notifications Fork 0 Star 0

Code Issues Pull requests Actions Projects Security Insights

Files

main

Go to file

adamapiresult

images

README.md

timeSeries.ipynb

notebooks / timeSeries.ipynb

source code on GitHub

fazzini changed link ce17176 · 2 hours ago History

Preview Code Blame 791 lines (791 loc) · 273 KB Raw

Time Series statistics on Air Quality model output

How to compute statistics (minimum, maximum and average) on single point time series and the plot visualization for a specific dataset in the Adam catalogue, in this case applied to the Air Quality model output provided by ARPAE, by using searching and filtering functionalities provided through the API.

Introduction

This notebook shows how to implement an advanced search operation for a specific dataset, by using the functionalities provided in the Adam API, by defining a search operation using the filters enabled for a dataset selected in the catalogue. It extracts minimum, maximum and average values from a time series, by using searching and filtering functionalities provided through the Adam API This notebook shows how to implement an advanced search operation for a specific dataset, by using the functionalities provided in the Adam API, by defining a

Funded by the European Union NextGenerationEU
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
esa

Exploring the S2 ET production environment starting from the IRIDE catalogue

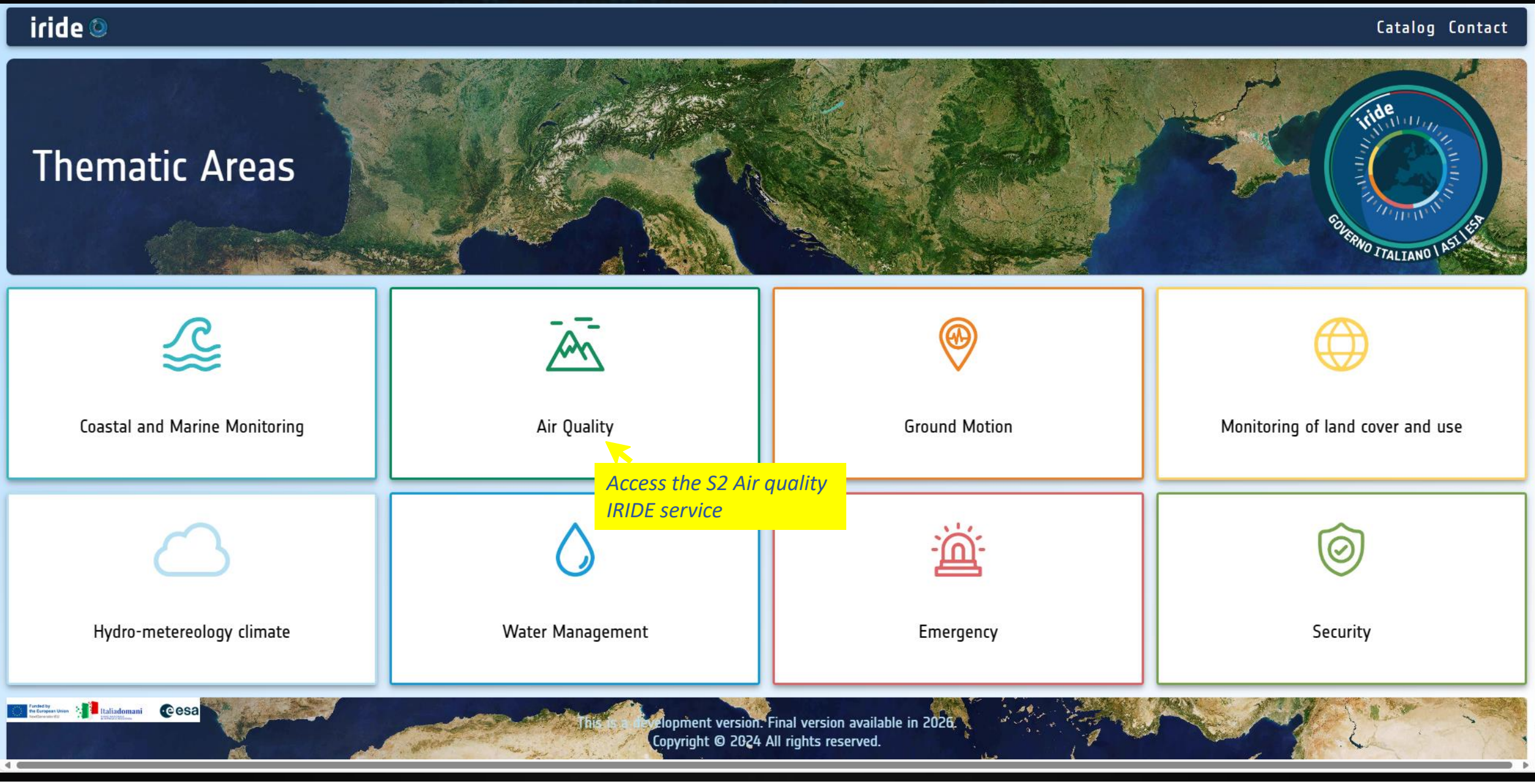
1) With the direct link to the S2 ET
https://explorer.iride.adamplatform.eu

2) Starting from IRIDE Catalogue:
https://dev-portal.irideservices.earth

Access the IRIDE catalogue with the IRIDE SSO account

Funded by the European Union NextGenerationEU
Italiadomani
esa

From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET



From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET
Example of SVC on-demand (SVC S2-03)

iride

Catalog Contact

Air Quality Monitoring and Forecast
[SE-S2-01]

Monitoring and assessment of pollutant emissions
[SE-S2-02]

Re-analysis of air quality at national scale
[SE-S2-03]

S2-02-03

Air quality

The main contribution of the IRIDE Service Segment in this application domain is a web service that provides 3D maps from prediction models, generated by institutional bodies. This platform allows access to all federated model data and satellite information necessary to support air quality monitoring and modeling activities. Moreover, the Service Segment of IRIDE provides geospatial products derived from satellite in support of pollutant monitoring.

The geospatial services of IRIDE dedicated to this application domain are:

- Support for monitoring and forecasting air quality
- Support for monitoring and evaluation of pollutant emissions
- Reanalysis of air quality on a national scale

Stefania Pasetti (pasetti@meeo.it) ha eseguito l'accesso

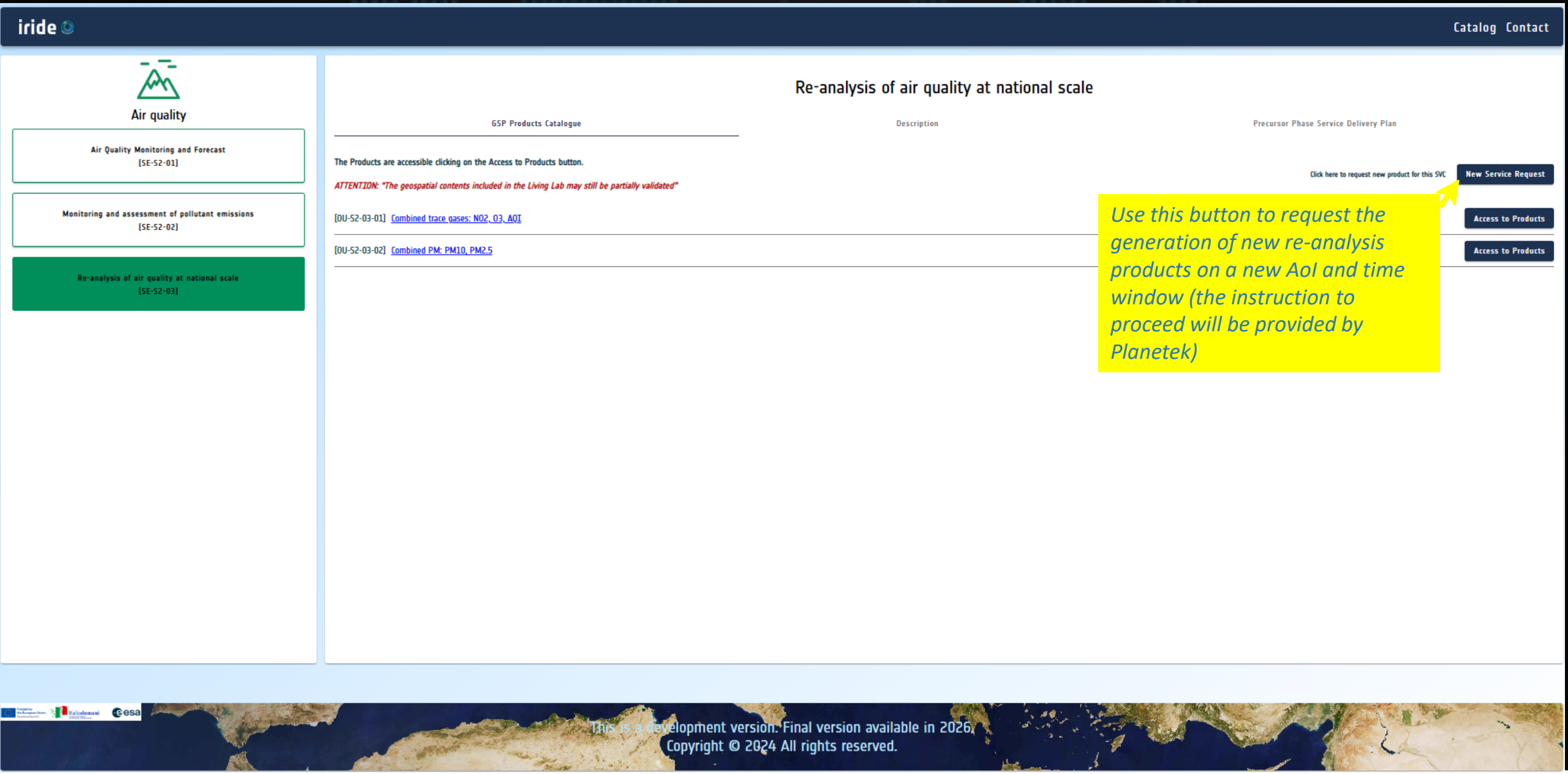
About the IRIDE constellation. The IRIDE constellation is a programme of the European Union – Next GenerationEU funded by the Presidency of the Council of Ministries of the Italian Republic, pursuant to Article 1, paragraph 254, of the Italian Law 160/2019 and Funded by the Presidency of the Council of Ministries from the Complementary Fund carried out under an ESA Contract for the purposes of EO PNRR IRIDE PROGRAMME.

Funded by the European Union NextGenerationEU

Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA

esa

From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET
Example of SVC on-demand (SVC S2-03)

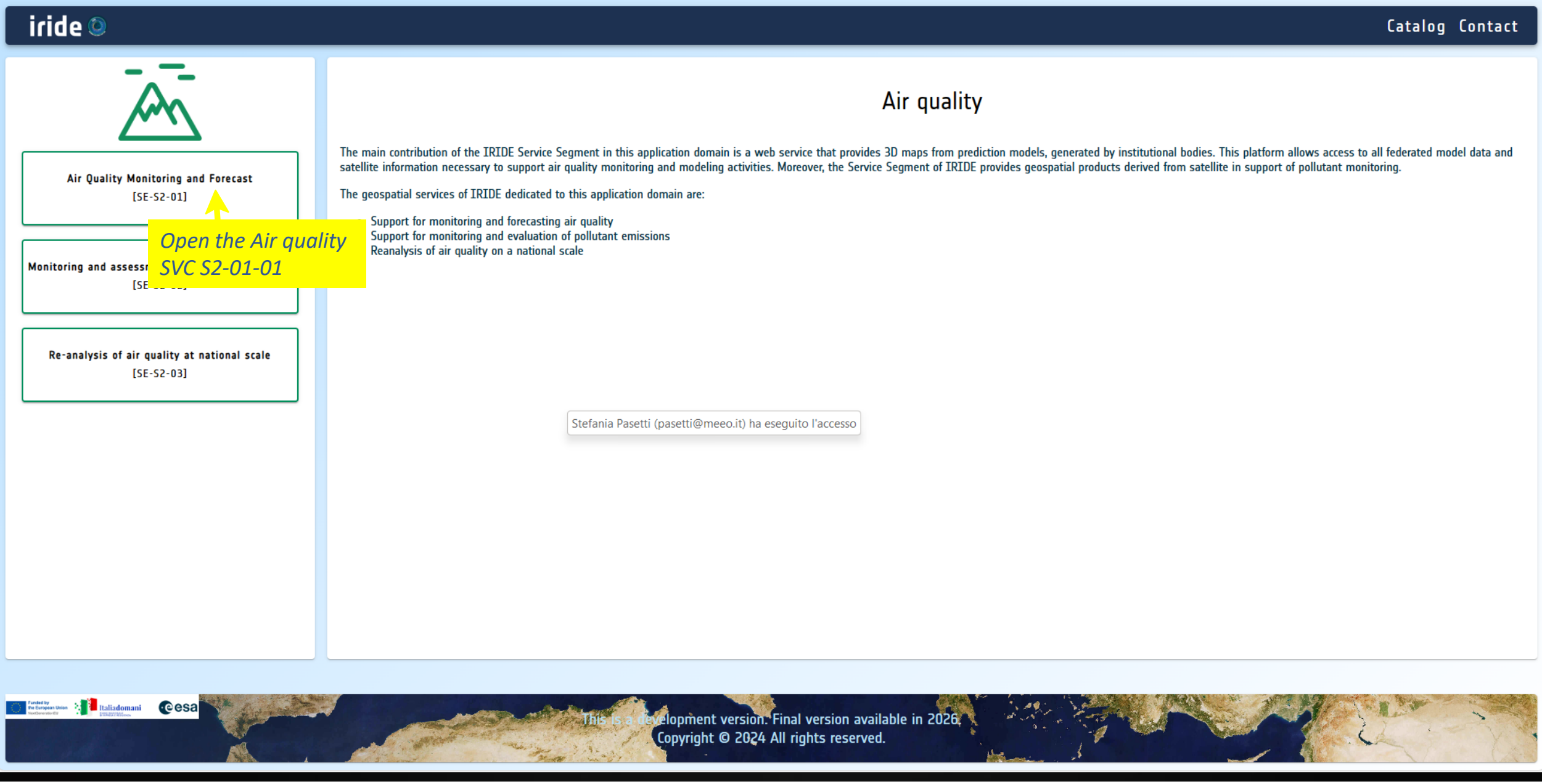


About the IRIDE constellation. The IRIDE constellation is a programme of the European Union – Next GenerationEU funded by the Presidency of the Council of Ministries of the Italian Republic, pursuant to Article 1, paragraph 254 of the Italian Law 160/2019 and Funded by the Presidency of the Council of Ministries from the Complementary Fund carried out under an ESA Contract for the purposes of EO PNRR IRIDE PROGRAMME.

Disclaimer. Views expressed herein can in no way be taken to reflect the official opinion the European Union/European Commission/ESA/Presidency of Council of Ministers of the Italian Republic. Views and opinion expressed are those of the author(s) only and the European Union/European Commission/ESA/Presidency of Council of Ministers of the Italian Republic cannot be held responsible for any use which may be made of the information contained therein.

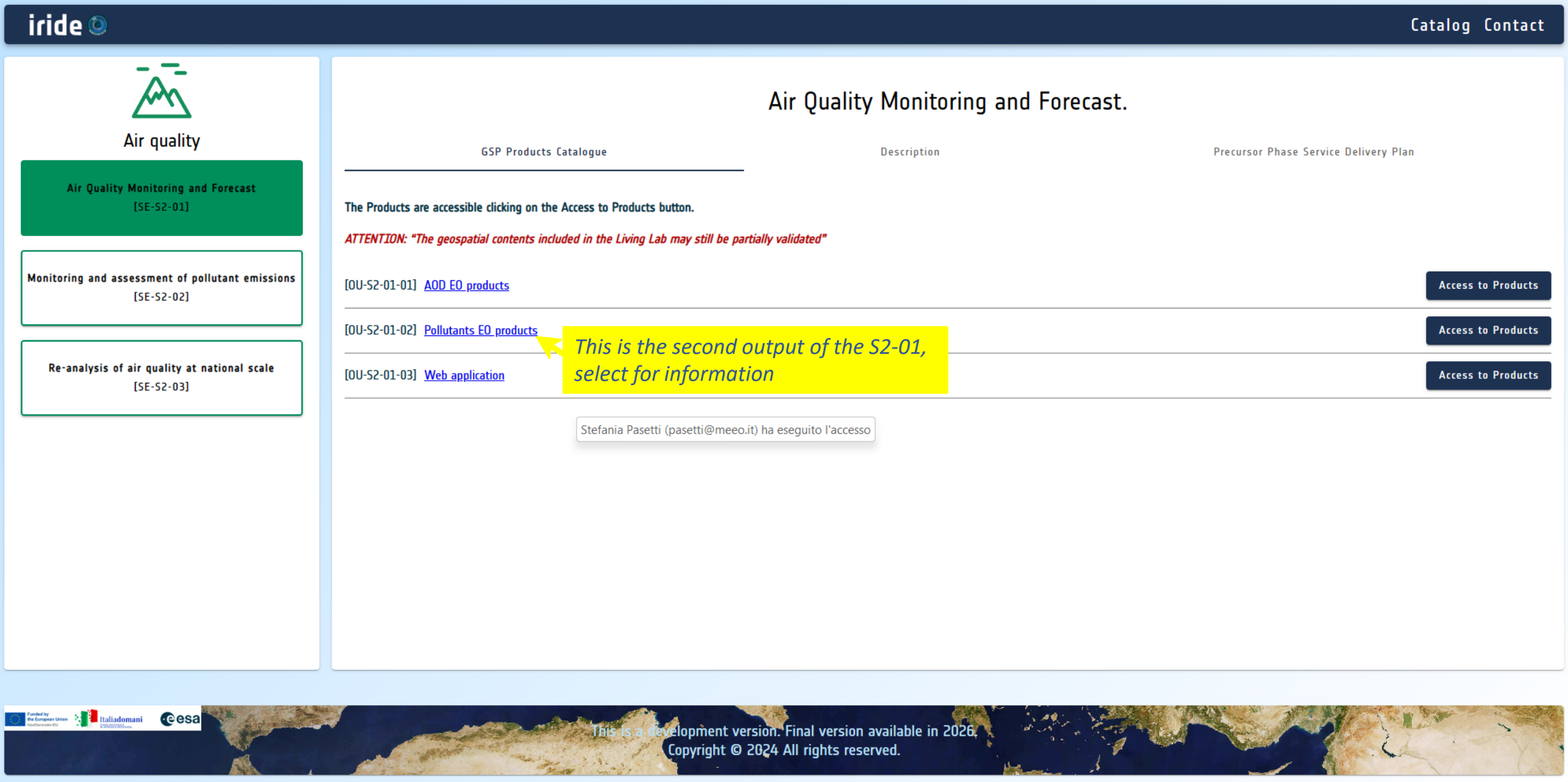
Funded by the European Union NextGenerationEU
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
esa

From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET
Example of a systematic SVC (SVC S2-01)

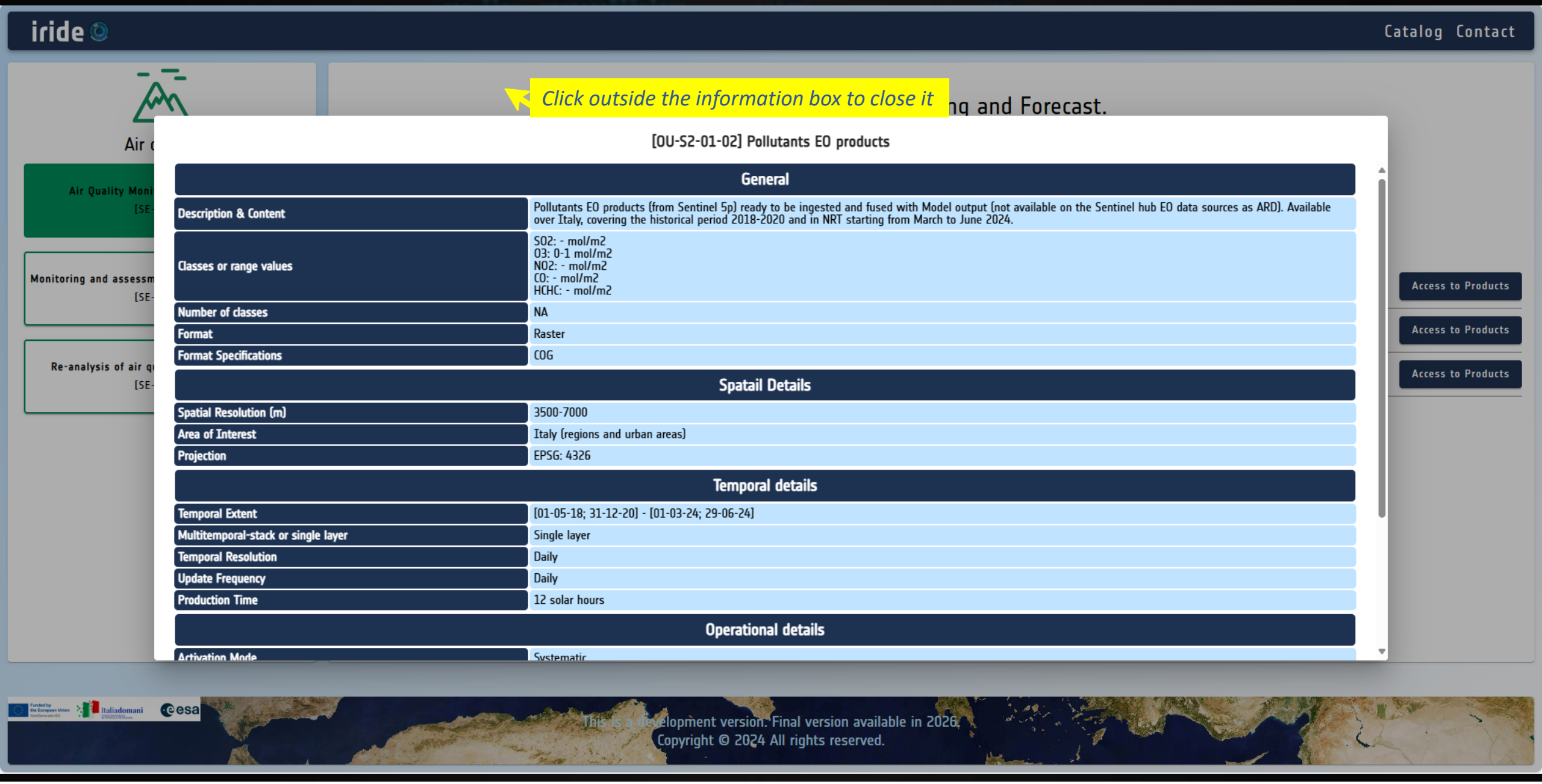


Funded by the European Union NextGenerationEU
Italiadomani
esa

From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET
Example of a systematic SVC (SVC S2-01)



From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET



From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET

iride

Catalog Contact

Air quality

Air Quality Monitoring and Forecast
[SE-S2-01]

Monitoring and assessment of pollutant emissions
[SE-S2-02]

Re-analysis of air quality at national scale
[SE-S2-03]

Air Quality Monitoring and Forecast.

GSP Products Catalogue | Description | Precursor Phase Service Delivery Plan

The Products are accessible clicking on the Access to Products button.

ATTENTION: "The geospatial contents included in the Living Lab may still be partially validated"

[OU-S2-01-01] AOD EO products — Access to Products

[OU-S2-01-02] Pollutants EO products — Access to Products

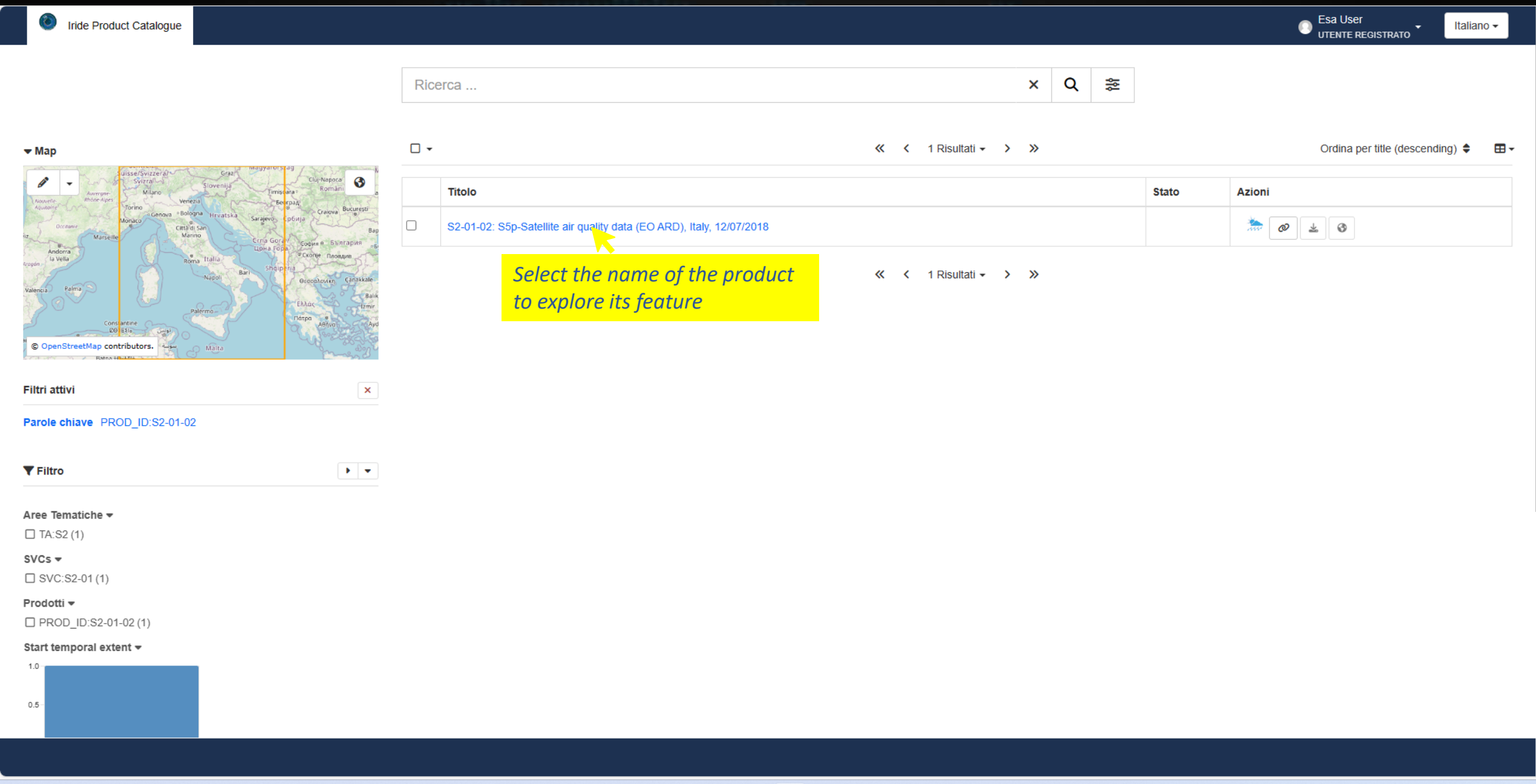
[OU-S2-01-03] Web application — Access to Products

Select the related tab ACCESS TO PRODUCT to access it

Stefania Pasetti (pasetti@meeo.it) ha eseguito l'accesso

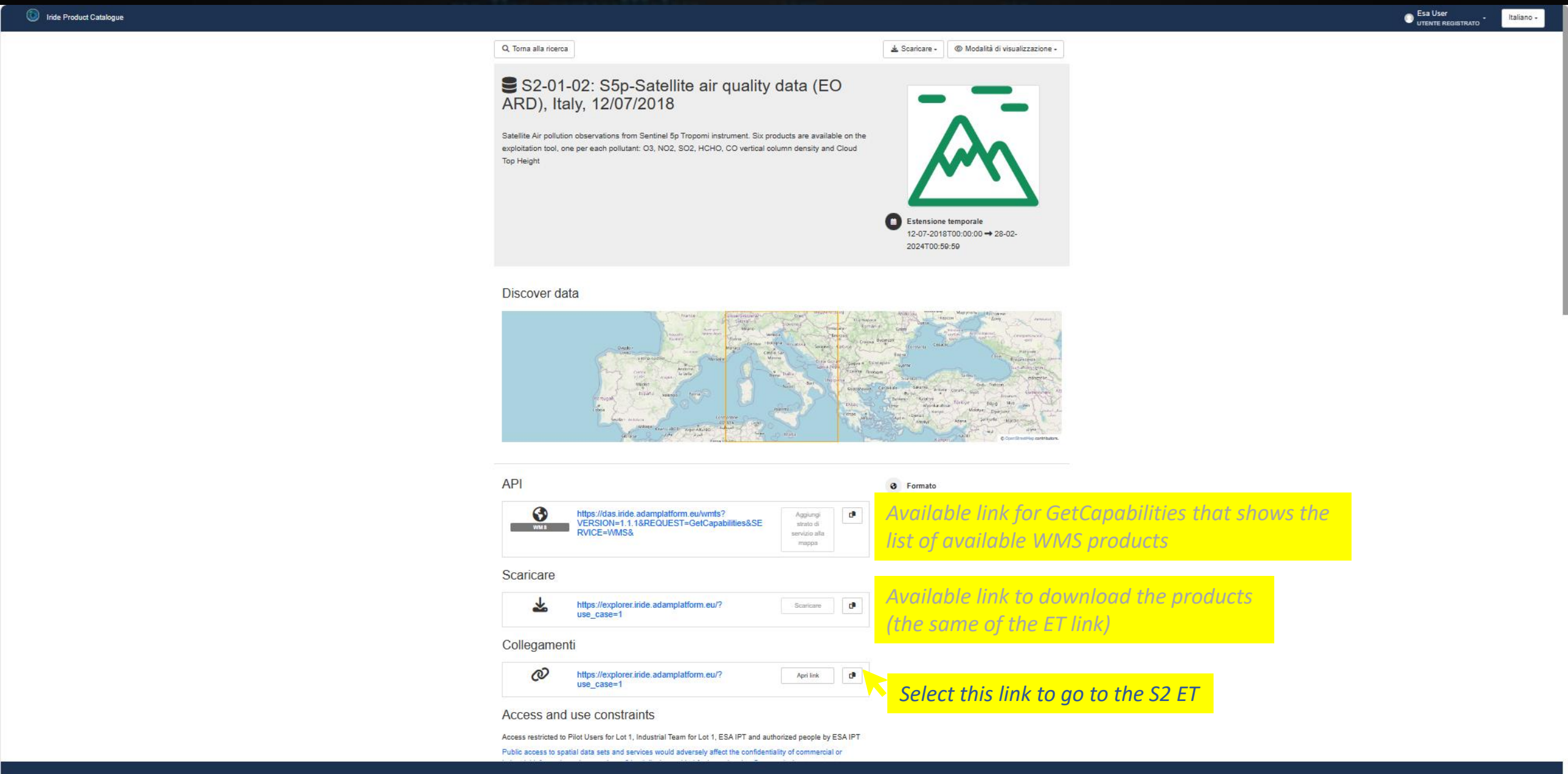
Funded by the European Union NextGenerationEU
Italiadomani
esa

From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET



Funded by the European Union NextGenerationEU
Italiadomani
esa

From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET



Funded by the European Union NextGenerationEU
Italiadomani
esa

S2-01-01 web application https://explorer.iride.adamplatform.eu

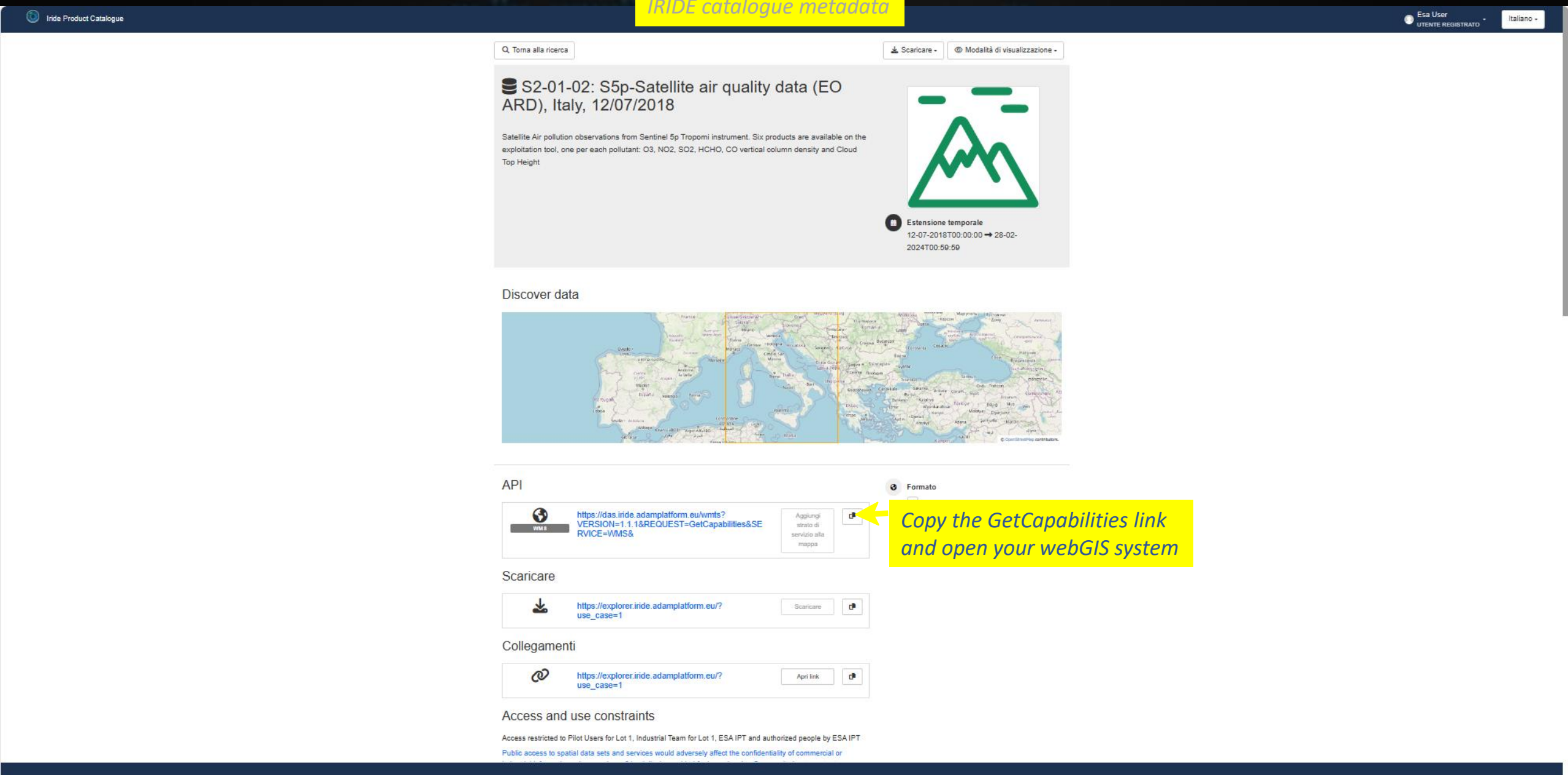
Welcome back to S2 ET

you can go back to slide n.4 or, as alternative, if you want to visualize the products ***into your webGIS system,*** *please follow the next instructions*

Funded by the European Union NextGenerationEU
Italiadomani
esa

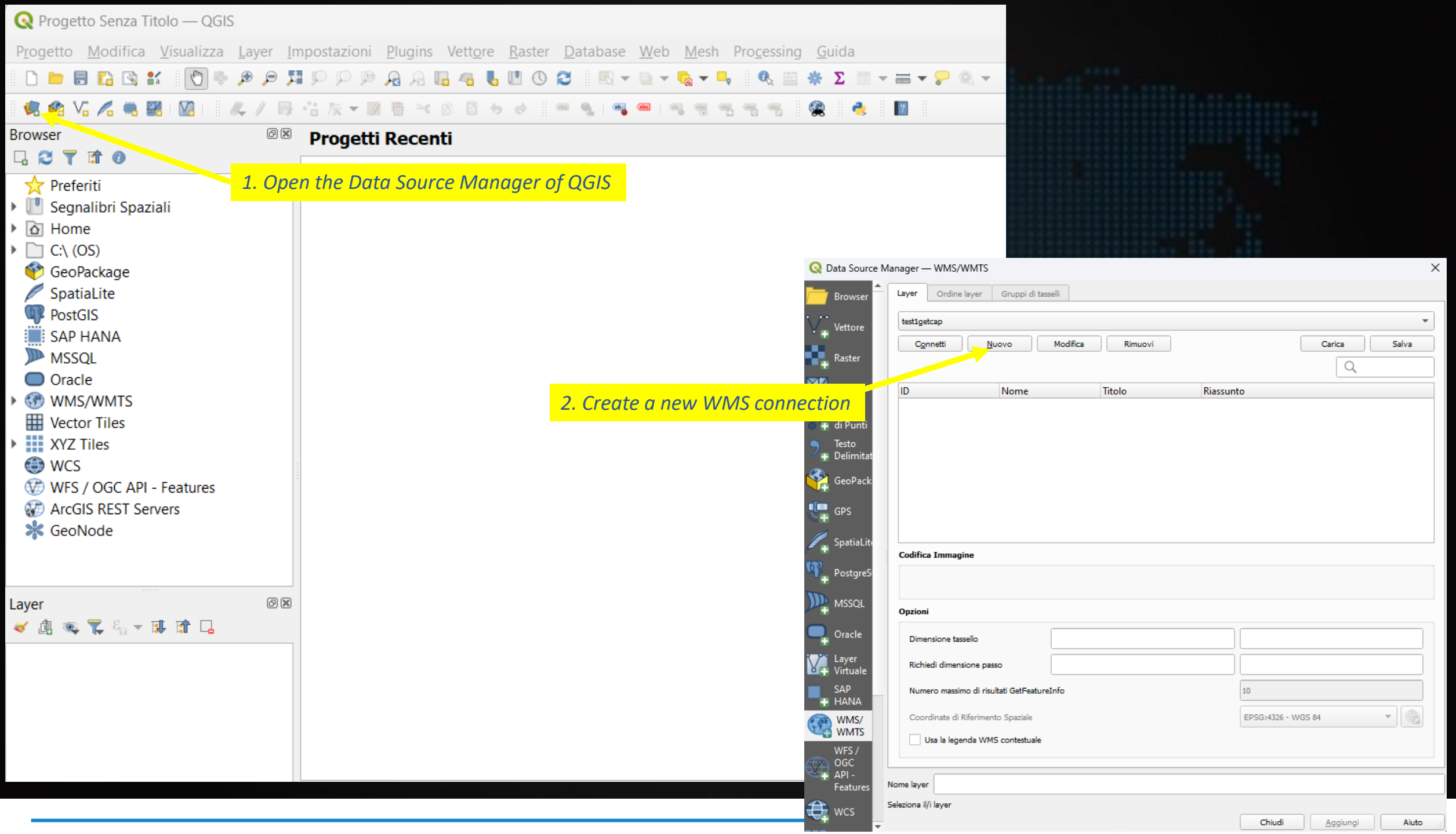
From IRIDE Catalogue https://dev-portal.irideservices.earth to visualize WMS layers

IRIDE catalogue metadata



Funded by the European Union NextGenerationEU
Italiadomani
esa

Instruction on how to use the WMS link: example on QGIS



Funded by the European Union NextGenerationEU
Italiadomani
esa

Instruction on how to use the WMS link: example on QGIS

1. Name the connection as you prefer

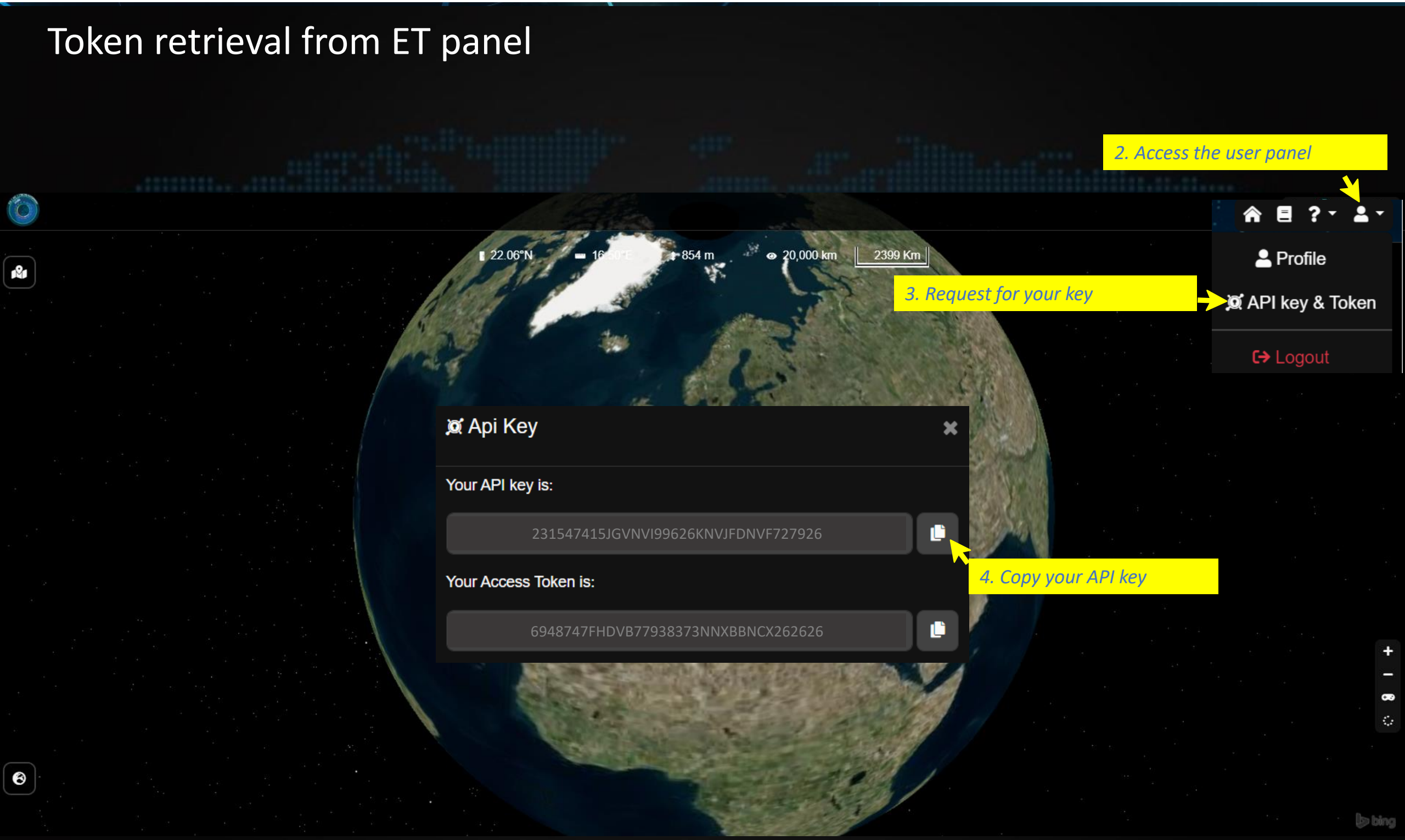
2. Paste the API/WMS link (copied from the IRIDE catalogue) but a token is required to be added…

IRIDE catalogue metadata

3. To retrieve your token, login to ET from IRIDE catalogue (or directly https://explorer.iride.adamplatform.eu)

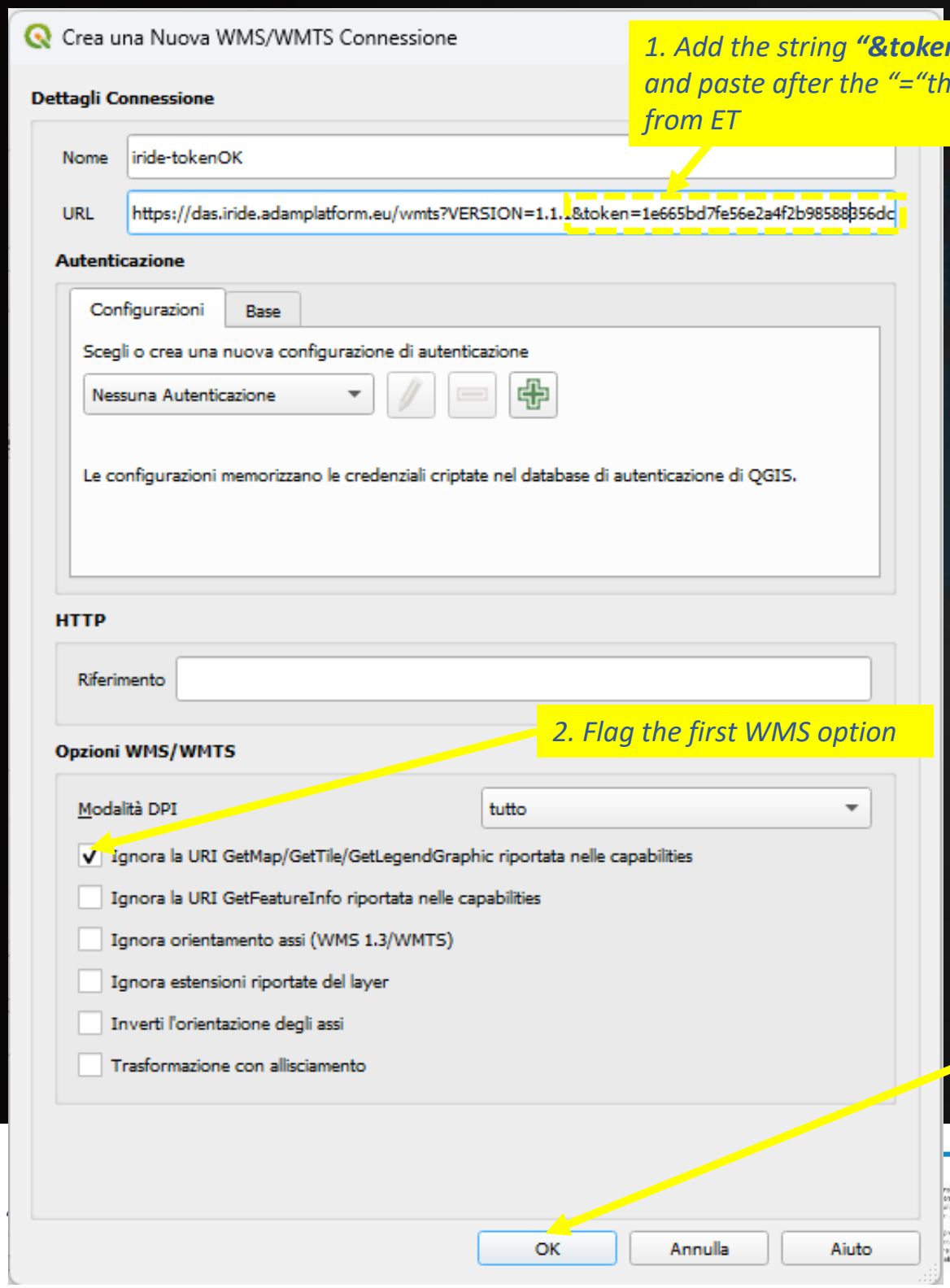
Funded by the European Union NextGenerationEU

Token retrieval from ET panel

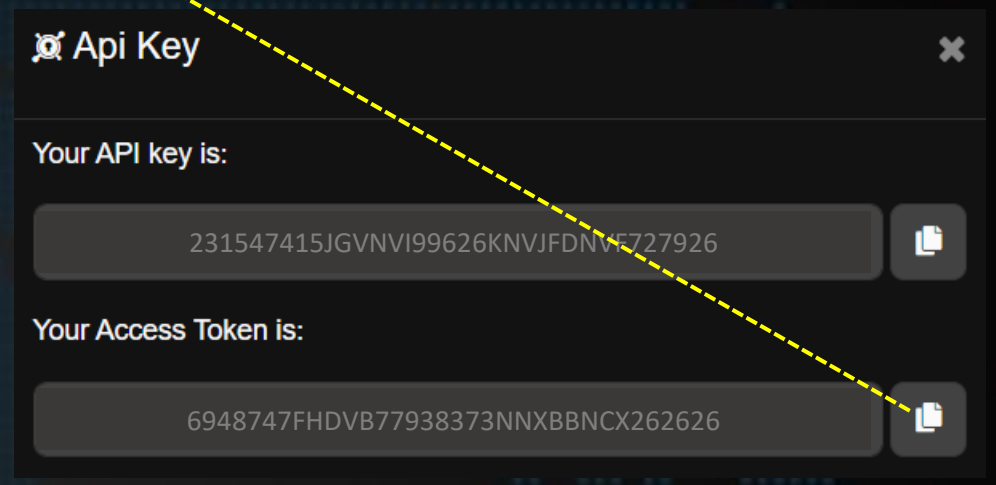


Funded by the European Union NextGenerationEU
Italiadomani
esa

Instruction on how to use the WMS link: example on QGIS



*1. Add the string **"&token="** to the URL and paste after the "="the token retrieved from ET*



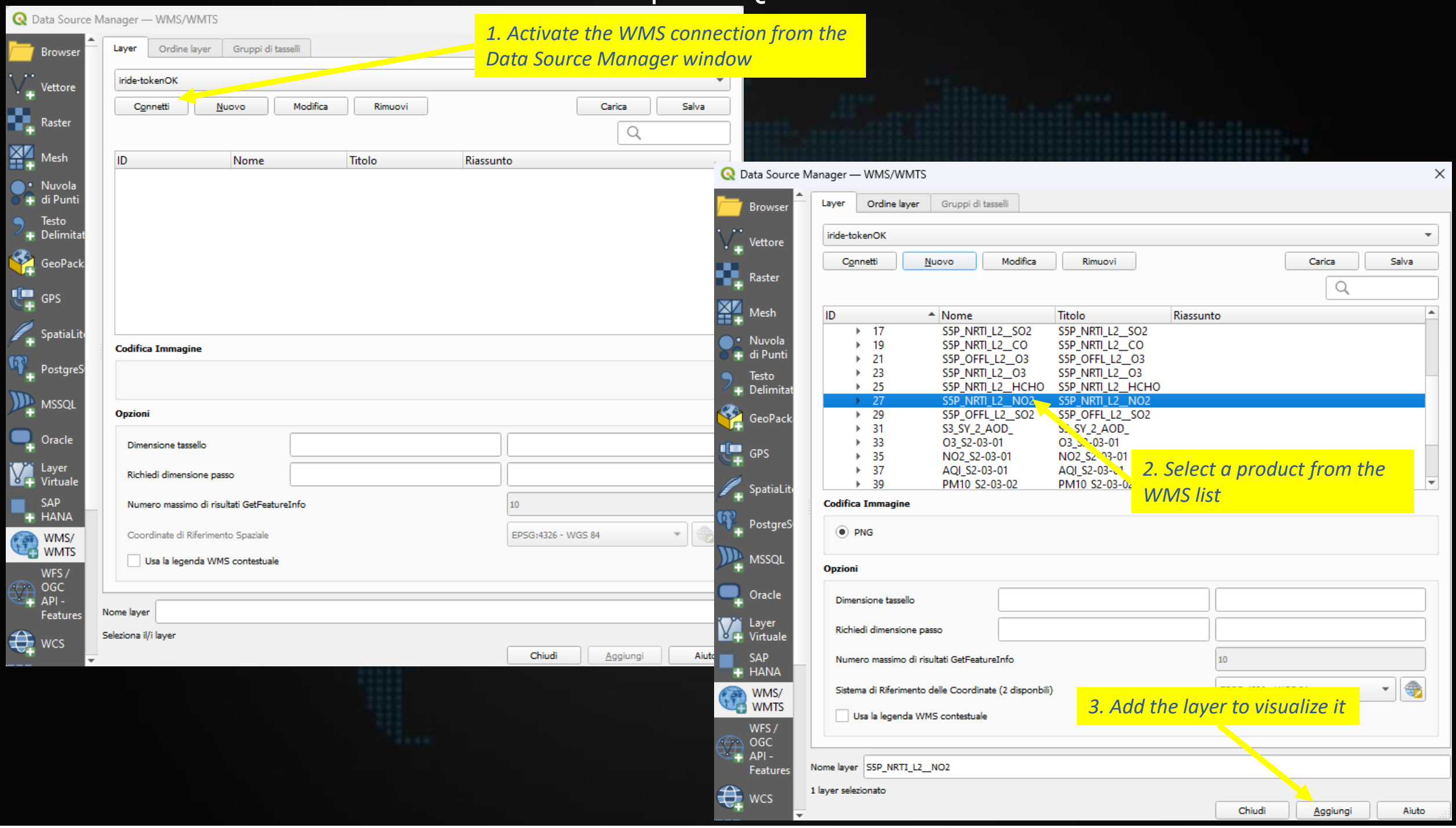
Please be sure to copy the most updated token from the ET platform as it has been refreshed every hour

2. Flag the first WMS option

3. Close the created connection

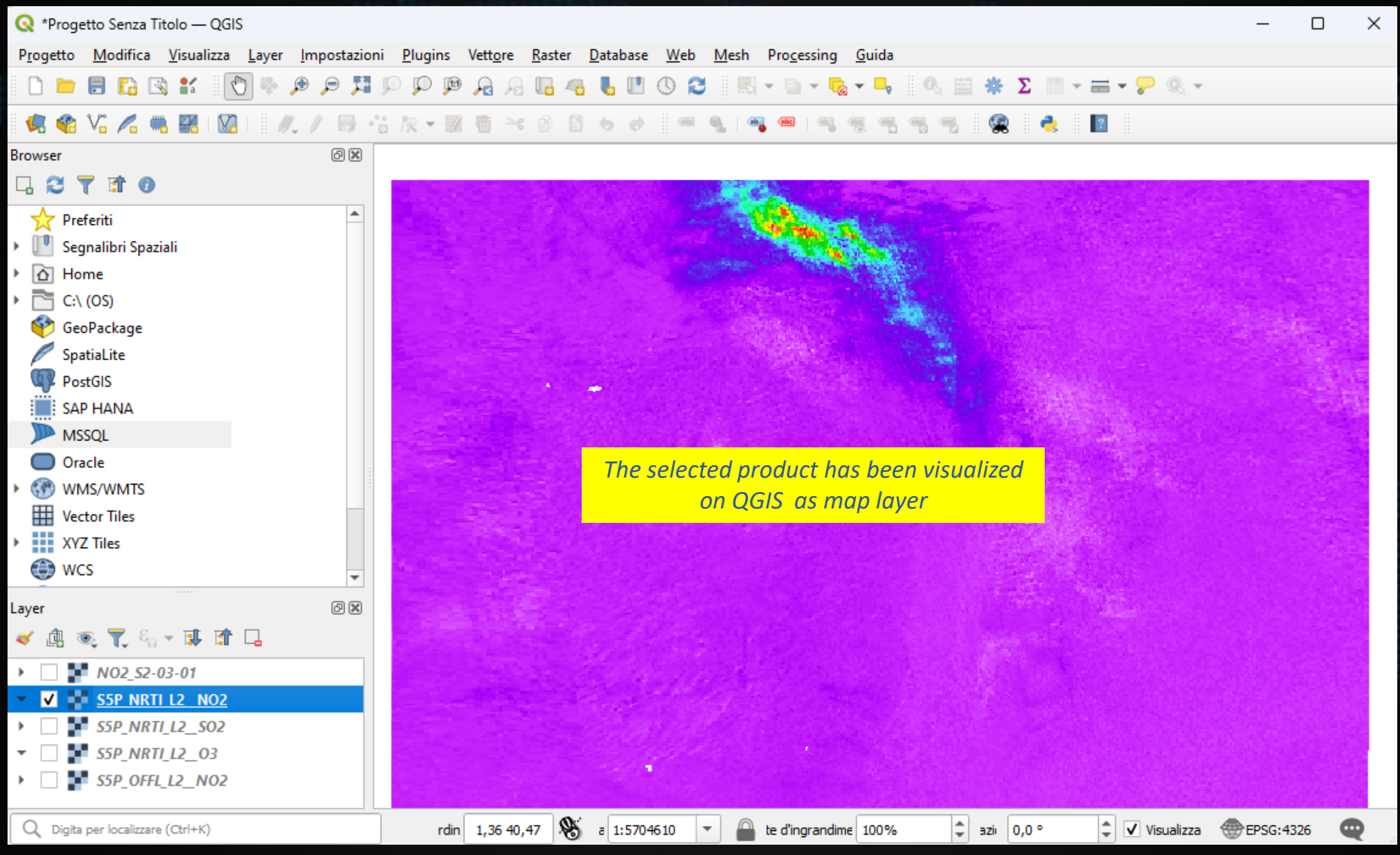
Funded by the European Union NextGenerationEU
Italiadomani
esa

Instruction on how to use the WMS link: example on QGIS



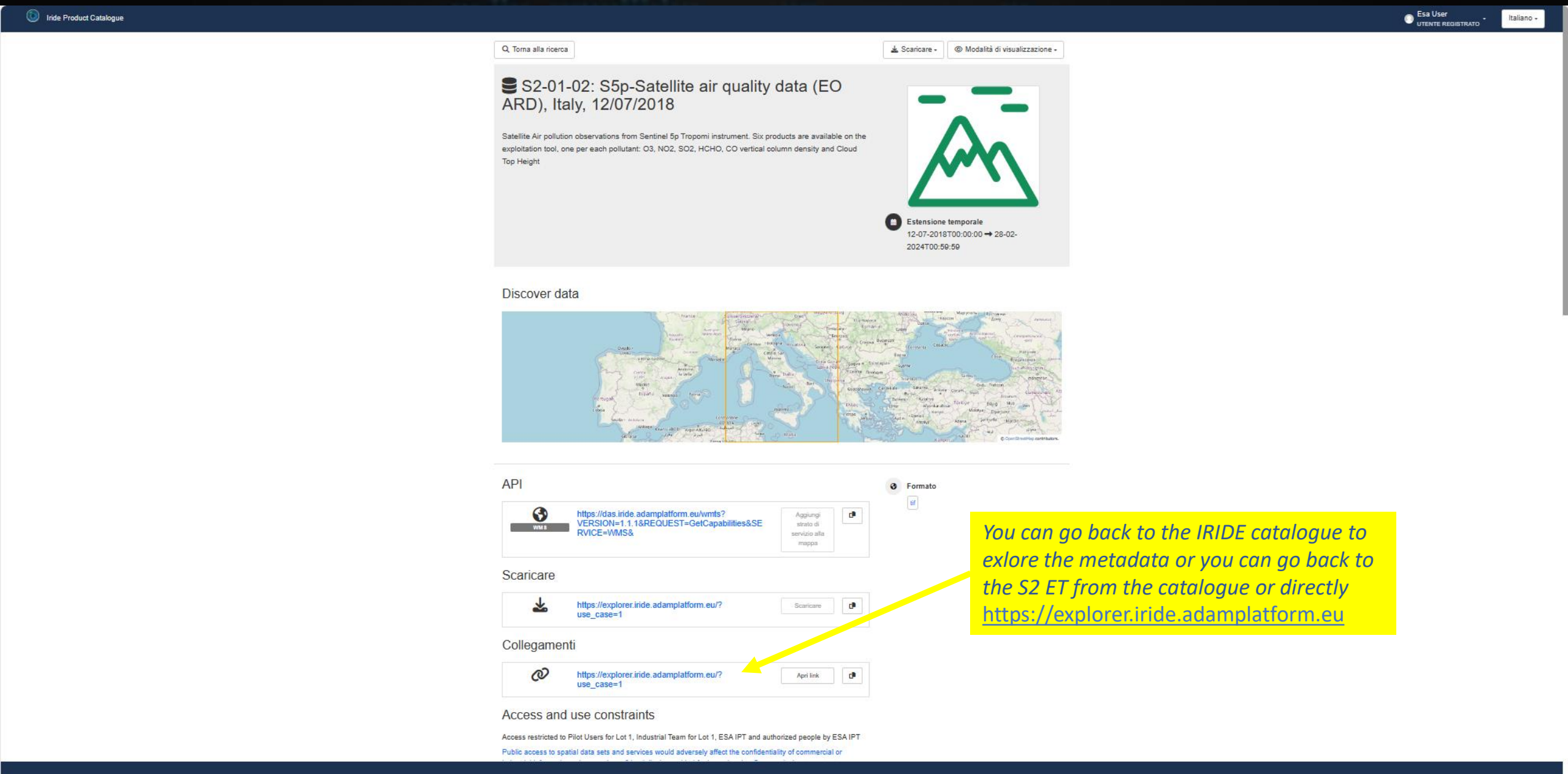
Funded by the European Union NextGenerationEU
Italiadomani
esa

Instruction on how to use the WMS link: example on QGIS



Funded by the European Union NextGenerationEU
Italiadomani
esa

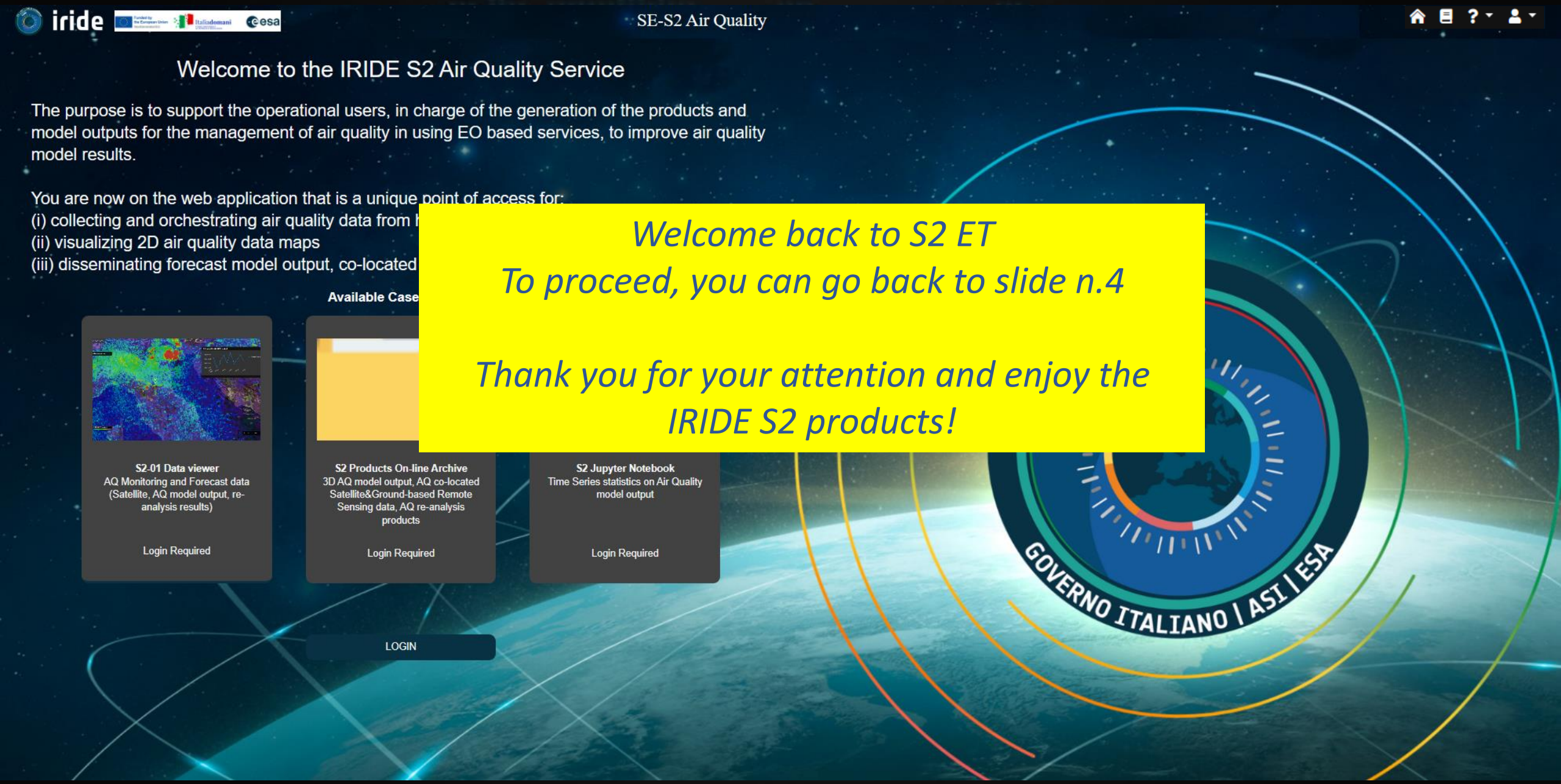
From IRIDE Catalogue https://dev-portal.irideservices.earth to S2 ET



You can go back to the IRIDE catalogue to exlore the metadata or you can go back to the S2 ET from the catalogue or directly https://explorer.iride.adamplatform.eu

Funded by the European Union NextGenerationEU
Italiadomani
esa

Hands-on session (S2-01-01 web application) https://explorer.iride.adamplatform.eu



Welcome back to S2 ET
To proceed, you can go back to slide n.4

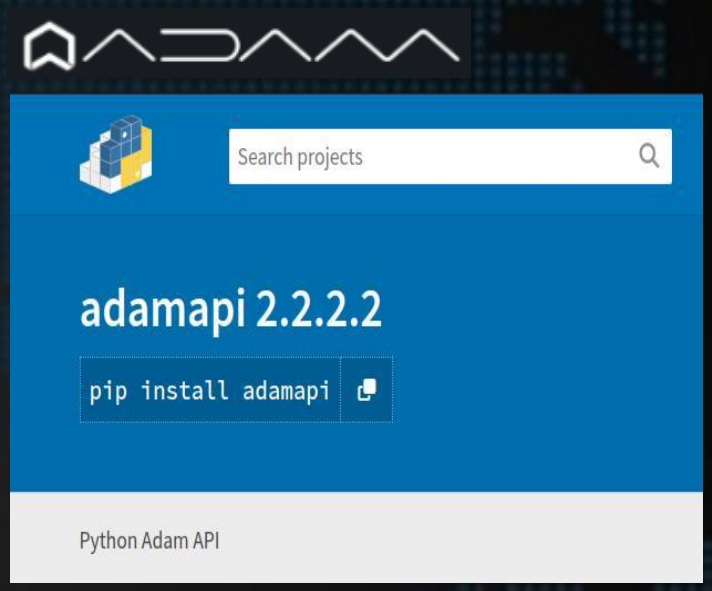
Thank you for your attention and enjoy the IRIDE S2 products!

Funded by the European Union NextGenerationEU
Italiadomani
esa

SECTION 2 – IRIDE S2 APIs (ADAMAPI) for machine-to-machine data access

The IRIDE S2 APIs are based on the **available ADAMAPI** and they allow:

- access to the complete list of datasets
- access to the products contained by such dataset
- access to datasets metadata
- access to the datasets and their download
  - in native size
  - through sub-setting
  - through the product Identifier



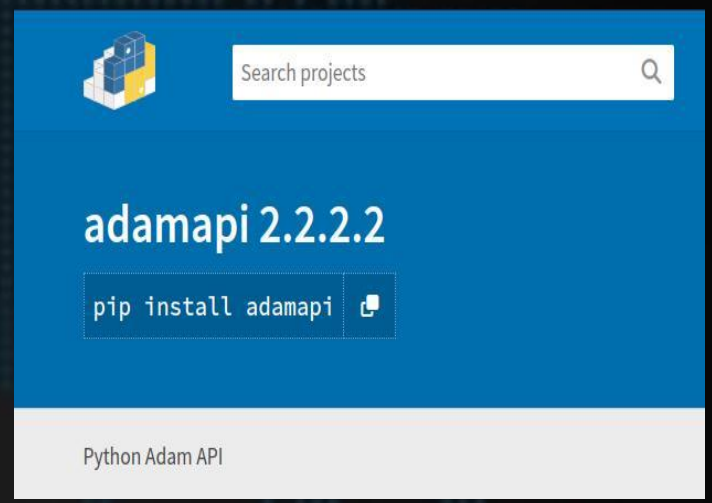
Please remind that the APIs of the S2 Service are available **to access the products registered on the WMS**,
so for ALL the data available on the S2 Data Viewer
(while 3D data like 3D output of FORAIR-IT, 3D output of kAIROS and the S2-02 output are accessible via ftp service and not through APIs)

Funded by the European Union NextGenerationEU
Italiadomani
esa

IRIDE S2 API – ADAMAPI Installation (tested on Ubuntu 20.04 and Ubuntu 22.04)

1. **Access service :** https://pypi.org/project/adamapi/

   At this link you can find:
   - *Intructions for the installation*
   - *Description of the 4 available modules (Auth, Datasets, Search, GetData)*
   - *Examples*
   - *Data format*



2. **Install with pip**

```
VENVNAME="adamapi"
python3 -m venv "${VENVNAME}"
source "${VENVNAME}/bin/activate";
python3 -m pip install --upgrade pip;
pip install adamapi
ln -s "/usr/lib/python3/dist-packages/osgeo" "${VENVNAME}/lib/python3.8/site-packages/osgeo"
```


Funded by the European Union NextGenerationEU
Italiadomani
esa

IRIDE S2 API - Modules of ADAMAPI

Modules to be installed:

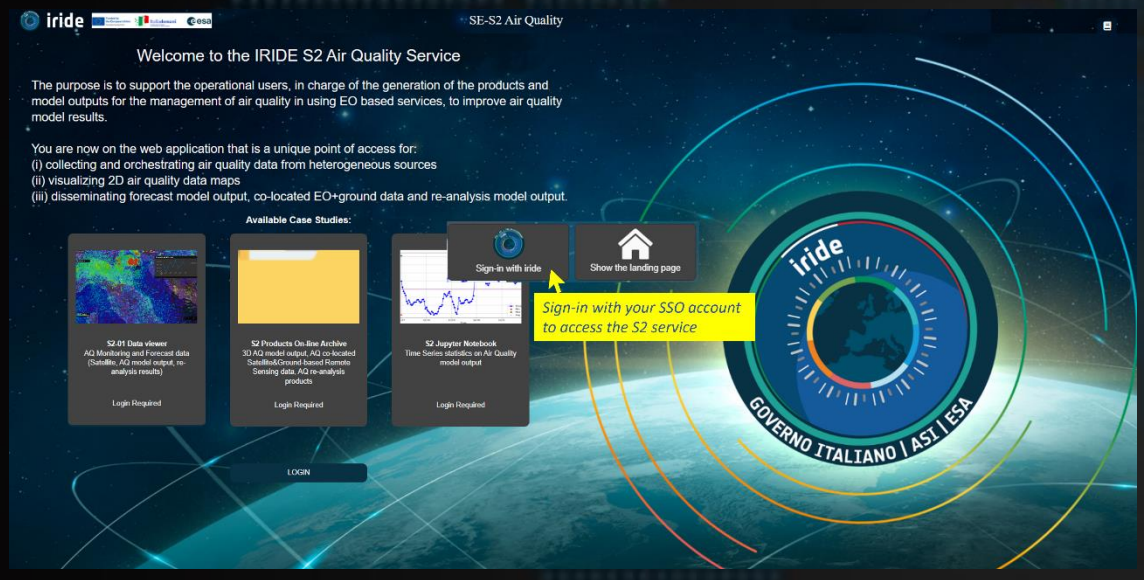
A. **Auth -** authorization module
B. **Dataset -** list of datasets
C. **Search** - list of products including associated metadata
D. **GetData** - to retrieve products (subsettting in space and time, downloading data in native granularity and with reduced processing capacity)

Funded by the European Union NextGenerationEU
Italiadomani
esa

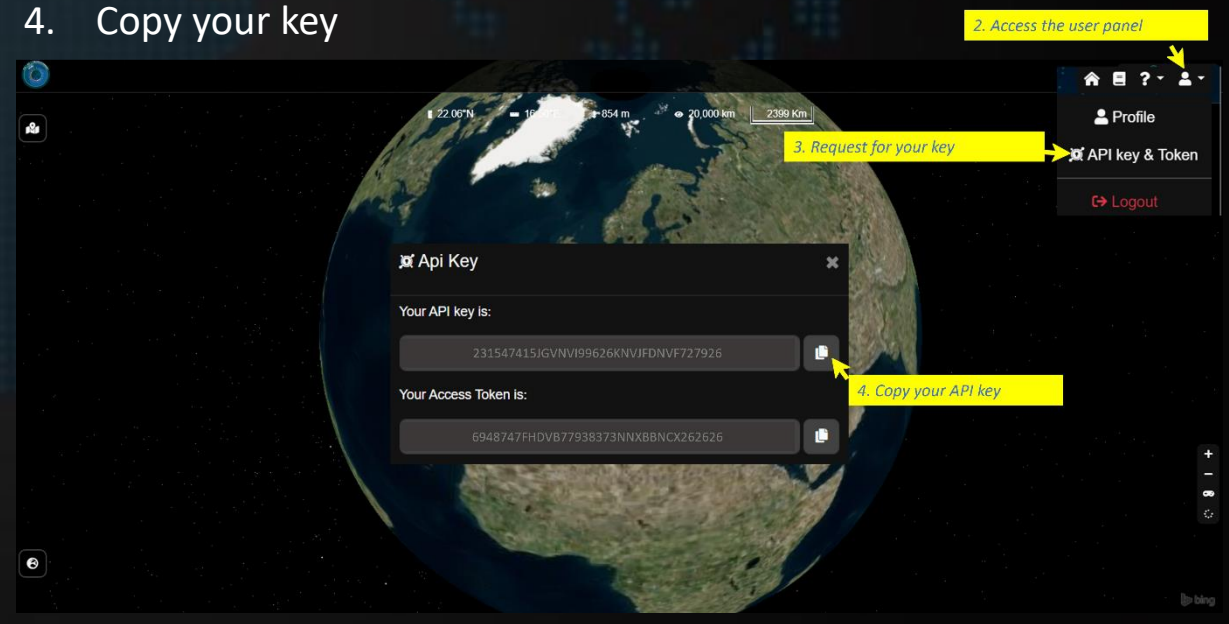
How to use IRIDE S2 APIs - STEP 1 APIKEY retrieval

The authorization step requires the user to retrieve his/her own APIKEY, an alphanumeric string uniquely associated with the user on the endpoint.

1. Go to the IRIDE S2 ET



2. Access the user panel
3. Request for API Key
4. Copy your key



Funded by the European Union NextGenerationEU
Italiadomani
esa

How to use IRIDE S2 APIs - STEP 2 getAuthorization

- Retrieve APIKEY from IRIDE S2 ADAM instance
- Set IRIDE S2 ET URL (https://explorer.iride.adamplatform.eu) and your APIKEY

STEP 2 getAuthorization

[3]:
```
API_Key = input('Type your ADAM API Key : ')
clear_output(wait=True)
Endpoint_URL = input('Type the URL for the selected endpoint : ')
clear_output(wait=True)
```

[4]:
```
auth = Auth()
auth.setKey(API_Key)
auth.setAdamCore(Endpoint_URL)
auth.authorize()
```

(by using Jupyter Notebook)

Funded by the European Union NextGenerationEU
Italiadomani
esa

How to use IRIDE S2 APIs – STEP 3 Dataset discovery

Working on datasets by the DATASET module:

- to retrieve the list of available IRIDE S2 datasets on Italy AoI on 18 April 2024

STEP 3 Dataset discovery

```
datasets = Datasets(auth)
listdata = datasets.getDatasets()

total = listdata['properties']['totalResults']

print(Style.BRIGHT + Fore.BLUE + '\033[1m' + f"List of {total} Datasets retrieved by ADAM API:")
print ('\033[0m')
for dataset in listdata['features']:
    datasets.getDatasets(dataset['datasetId'], page = 0, maxRecords = 10)
    print("Data Provider: ", dataset['license']['dataProviderName'])
    print("Title: ", dataset['title'])
    print("DatasetId: ", dataset['datasetId'])
    print("From: ", dataset['minDate'])
    print("To: ", dataset['maxDate'])
    print("Geometry: ", dataset['geometry'])
    print(Style.BRIGHT + "--------------------------------")
    print ('\033[0m')
```

(by using Jupyter Notebook)

Funded by the European Union NextGenerationEU
Italiadomani
esa

IRIDE S2 API - Dataset example

Output example of the STEP3 for IRIDE dataset retrieval on 18 April 2024

```
List of 21 Datasets retrieved by ADAM API:


Data Provider:  MEEO

Title:  Reanalysis-AQI_S2-03-01

DatasetId:  65e061bc438a52c7c6d12c43:AQI_S2-03-01

From:  2018-01-01T00:00:00Z

To:  2019-12-31T00:00:00Z

Geometry:  {'type': 'Polygon', 'coordinates': [[[12.3333627, 41.7842812], [12.6921652, 41.7842812], [12.6921652, 42.033883], [12.3333627, 42.033
883], [12.3333627, 41.7842812]]]}

------------------------------


Data Provider:  MEEO

Title:  kAIROS-model-NO2_S2-01-03

DatasetId:  6544b70a14ecf9c6d835831b:ARPAE_2D_NO2

From:  2024-04-21T23:00:00Z
```

……

(by using Jupyter Notebook)

Funded by the European Union NextGenerationEU
Italiadomani
esa

How to use IRIDE S2 APIs – STEP 4 Product search

Working on a datasets (Sentinel 5p NO2 NRT) by the SEARCH module:

- to SEARCH the products into the dataset

(by using Jupyter Notebook)

STEP 4 Product search ¶

```
datasetId = '65ddb540438a52c7c6cfd8f5:S5P_NRTI_L2__NO2'
geometry = '{"type":"Polygon","coordinates":[[[4.28225442182902,47.8950404622663],[4.28225442182902
start_date = '2024-04-18T00:00:40Z'
end_date = '2024-04-18T23:59:40Z'
```

```
listproducts = {}
search = Search(auth)

try:
    listproducts = search.getProducts(datasetId)
except Exception as e:
    print("Error downloading products metadata %s" %e)

try:
    listproducts = search.getProducts(datasetId, startDate=start_date, endDate=end_date, geometry=g
except Exception as e:
    print("Error downloading products metadata %s" %e)

print('\033[1m' + 'List of the 10 most recent products of '+Fore.RED +  datasetId.split(':')[1] )

for product in listproducts['features']:
    print ('\033[0m')
    print("Product Date: ", product['productDate'])
    print("Product Id: ", product['productId'])
    print("Product geometry: ", product['geometry'])
    print("\033[1;31;1m" + '-------------------------------------------------')
```

Results: the 4 products for 18/04/2024 for S5p NO2 NRT

```
List of the 10 most recent products of S5P_NRTI_L2__NO2


Product Date:  2024-04-18T13:30:40Z

Product Id:  S5P_NRTI_L2__NO2____20240418T133040_20240418T133540_33754_03_020600_20240
ioxide_summed_total_column_4326.tif

Product geometry:  {'geometries': [{'type': 'Polygon', 'coordinates': [[[1.4361648, 34
2], [1.4361648, 47.1762282], [1.4361648, 34.3662282]]]}], 'type': 'GeometryCollection'

---------------------------------------------


Product Date:  2024-04-18T11:50:40Z

Product Id:  S5P_NRTI_L2__NO2____20240418T115040_20240418T115540_33753_03_020600_20240
ioxide_summed_total_column_4326.tif

Product geometry:  {'geometries': [{'type': 'Polygon', 'coordinates': [[[1.4224105, 34
16], [1.4224105, 47.1768616], [1.4224105, 34.3668616]]]}], 'type': 'GeometryCollection

---------------------------------------------


Product Date:  2024-04-18T11:45:40Z

Product Id:  S5P_NRTI_L2__NO2____20240418T114540_20240418T115040_33753_03_020600_20240
```


Funded by the European Union NextGenerationEU
Italiadomani
esa

How to use IRIDE S2 APIs - STEP 5 Product access/download

Working on datasets by the GETDATA module:

- to download the 4 products in their native format over the defined geometry

STEP 5 Product access/download

```
filters = {
    "startDate":start_date,
    "endDate":end_date,
    "geometry":geometry
}
```

```
data = GetData(auth)
print("Downloading products over a defined area and date")
image = data.getData(datasetId, "GetFile", asynchronous=False, compress=False, rest = False, filters=filters, outputDir=f'S5P_NRTI_L2__NO2')
```

```
Downloading products over a defined area and date
100%|██████████| 4/4 [00:06<00:00,  1.59s/it]
```

(by using Jupyter Notebook)

Funded by the European Union NextGenerationEU
Italiadomani
esa

For any questions or comments on S2
do not hesitate to contact MEEO

pasetti@meeo.it
folegani@meeo.it

Funded by the European Union NextGenerationEU
Italiadomani
esa