Voilà dashboards for policy support

How and why we create Voilà dashboards at the Joint Research Centre of the European Commission

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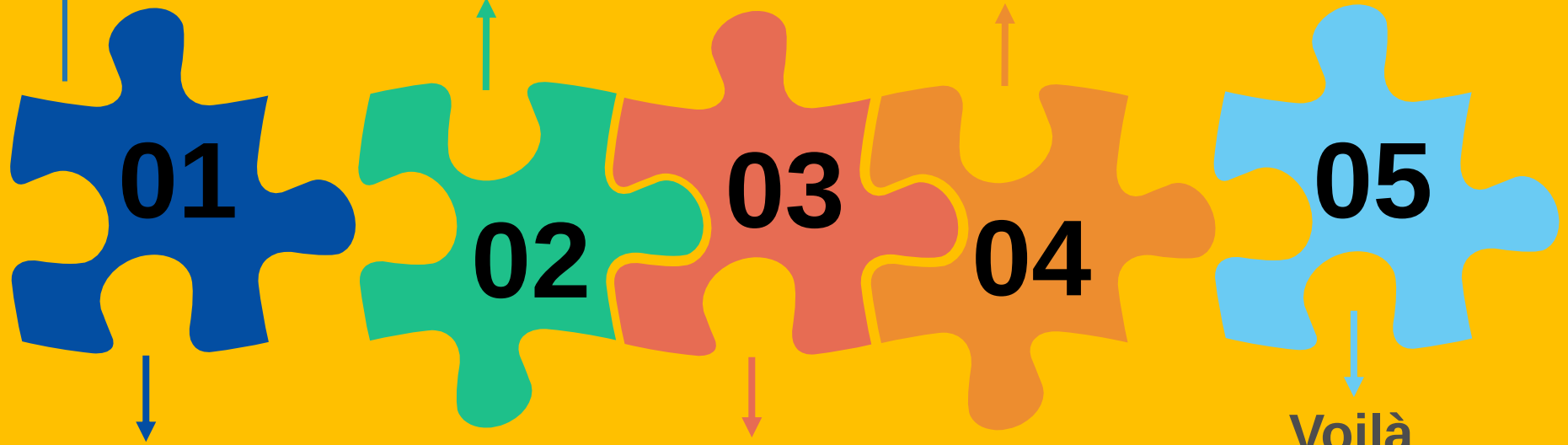
JupyterCon 12-16 October 2020

Joint Research Centre

Agenda



JRC and EC

Joint Research Centre and its role inside the European Commission.

Policy support

Exploit data volume, velocity, and variety to generate policy relevant information

JRC Big Data Platform

Storage, processing power, AI/ML, open source software stack for Data Analytics

Exploratory research

Jupyter notebooks used for big data visualization and data analytics/data processing

Voilà

Converting notebooks to apps and dashboards

European Commission

Joint Research Centre

Established in
1957

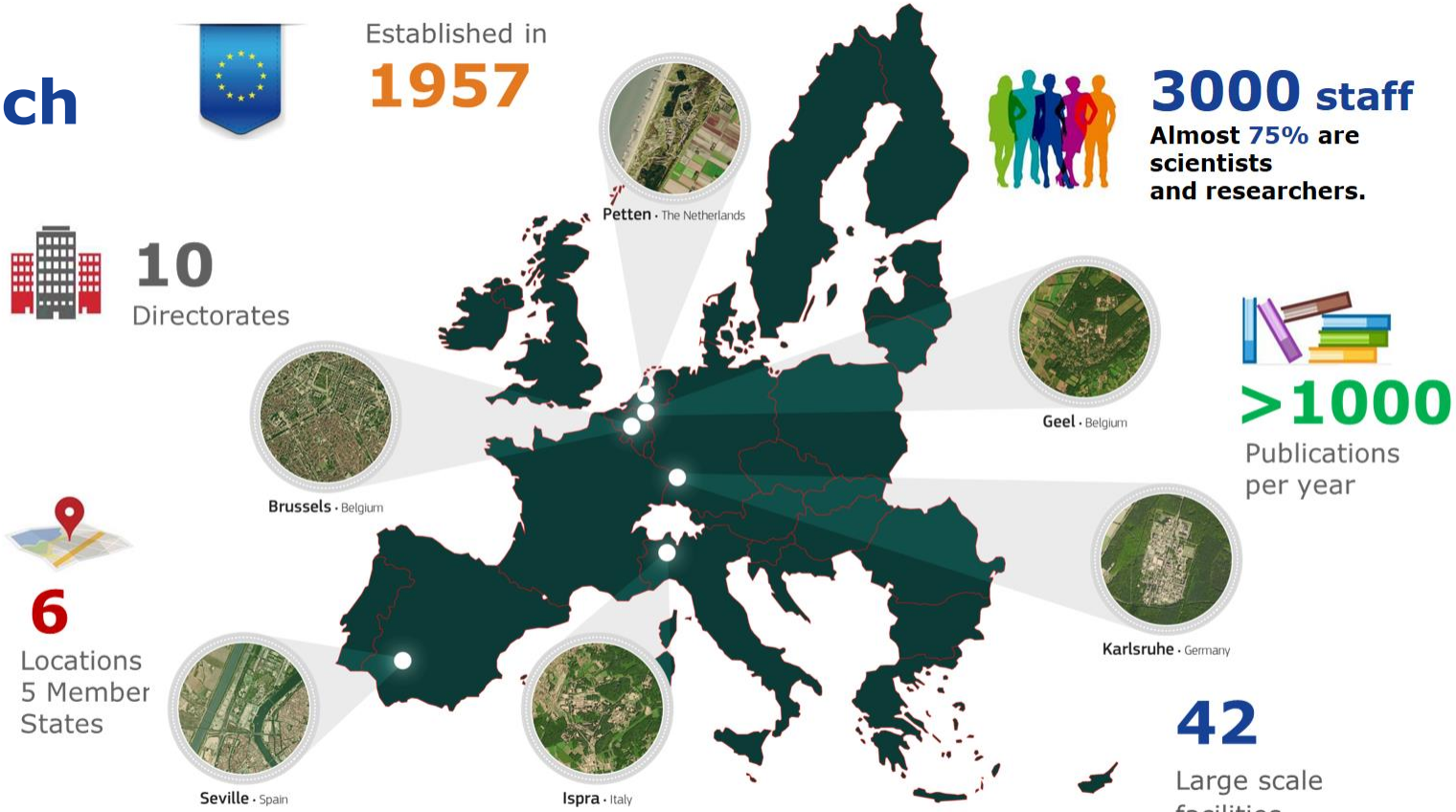
3000 staff
Almost 75% are scientists and researchers.

10
Directorates

>1000
Publications per year

6
Locations
5 Member States

42
Large scale facilities



Big (geospatial) data for policy

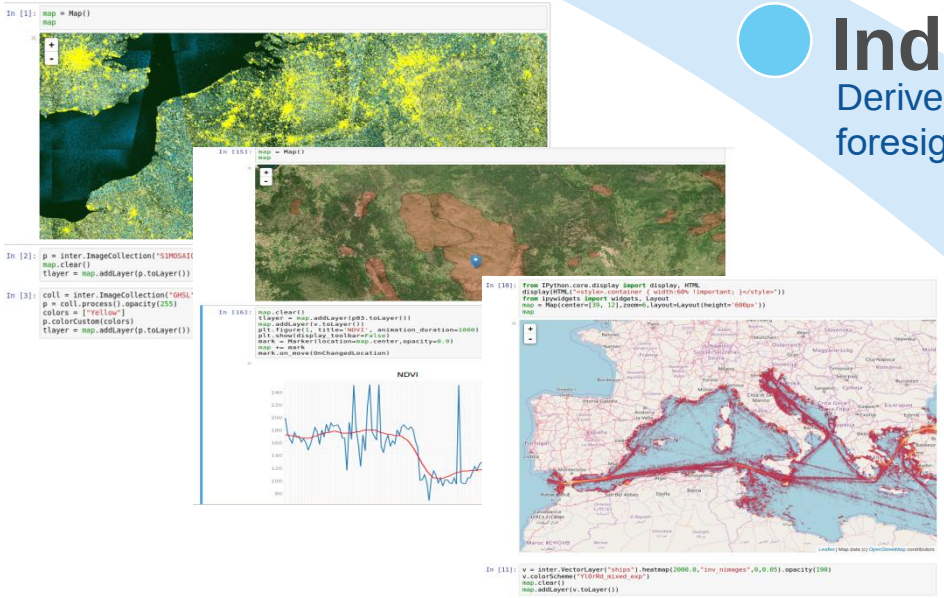
Exploit data volume, velocity, and variety to generate policy relevant information

Copernicus
Europe's eyes on Earth

- atmosphere
- marine
- land
- climate
- emergency
- security

Big data

Geospatial datasets linked with other types of datasets, …



Indicators

Derived products, insights, foresights, …

Decisions

Directives, legislations, communications, monitoring, …

Data Volume, Velocity, Variety

- Using FAIR data principles (findable, accessible, interoperable, reusable)
- Data mining competence in shared and collaborative environment
- Relying on reproducible workflows

Policy relevant information

JRC Big Data Platform

Security

- Encrypted protocol
- Multi-factor authentication

Hardware

- Petabyte scale data hub
- Co-located with computing cluster

Web-based services

- JupyterLab
- Remote data science desktop
- Distributed computing
- Development environments

Interactivity

- Novel interactive data analysis
- Exploratory visualisation tools

Machine Learning

- Specialized hardware
- Artificial Intelligence and Deep Learning modelling

Dissemination

- Web-based data dissemination
- Visualisation services
- Secure file transfer (ftps)

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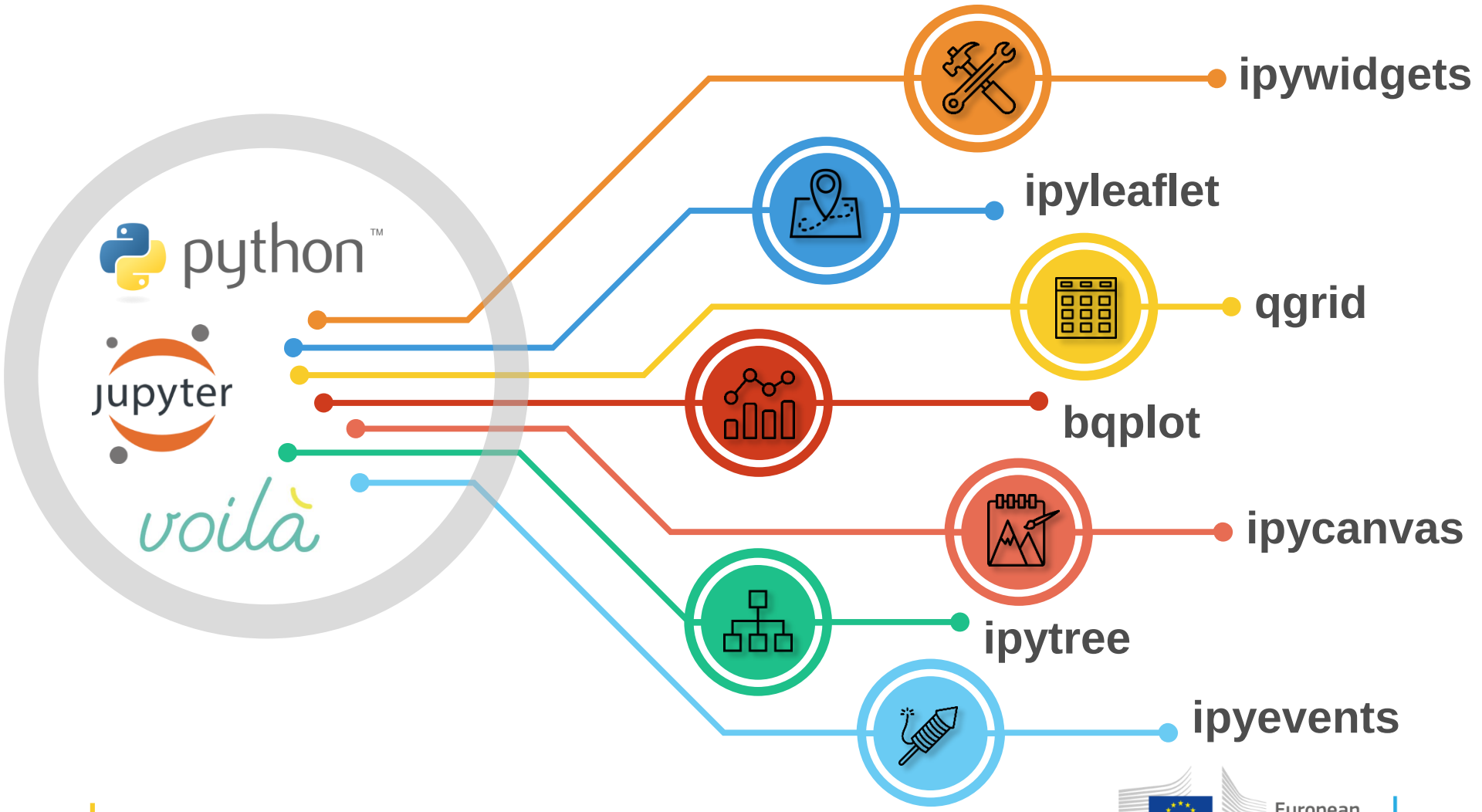
Main technologies

kubernetes

elasticsearch

Exploratory research and interactive visualisation



European Commission

What is Voilà?

It is a Jupyter notebook extension to automatically create standalone applications and dashboards.

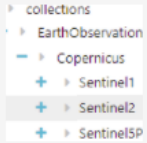
Notebooks are rendered by showing only the output of the cells, while the code is hidden.

Voilà is **suitable for non-technical experts** for communicating insights and foresight to a **wider audience.**

Voilà enables the complete development of modern data analytics workflows from research and innovation to **outreach** engaging **policy makers and citizens.**

Dashboards

Top stories



Geo-spatial browsing

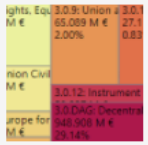
Collections Explorer

Interactively explore the geo-spatial datasets available inside the JEO-lab environment. Easily compare datasets and acccess specific Copernicus explorers

Pandemic monitoring

Covid-19 in Europe

Sinthetic visualization of daily cases, deaths and recovered in European countries. Compare countries by absolutes values and numbers normalized by population



Economic monitoring

Multi-annual EU budget expenditure analysis

Interactively analysis of EU budget with graphic visualisation and year-by-year expenditure comparison

Log-in to JEO-lab to create your own Voilà dashboards

Other dashboards

Covid-19 in Italian provinces

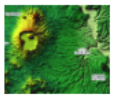
Map the evolution in time of the confirmed cases in Italian provinces

Data accessed on-the-fly from Protezione Civile github repository

Covid-19 in the world

COVID-19 dynamic mapping dashboard on world countries

Data accessed on-the-fly from Webcritech web portal (JRC E.1 unit)



Digital Elevation Models explorer

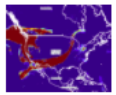
Interactively explore the global DEMs

Easily compare DEMs to understand changes

Sentinel-2 explorer

Interactively browse the full collection of Sentinel-2 products

Experiment band combinations and on-the-fly indexes calculation



Sentinel-5P explorer

Map pollution and emissions at global scale

Analyse fires, dust clouds, ozone and other global phenomena

LUCAS: Land Use and Coverage Area frame Survey

Harmonised surveys across all EU to gather information on land cover and land use

Monitor the Common Agricultural Policy

58 Billions budget | 38% EU budget | Direct payments to farmers | Need for Controls!

On The Spot Checks

- 5% Sample
- Few snapshots
- Visual checks
- Field visits

Copernicus/Sentinel

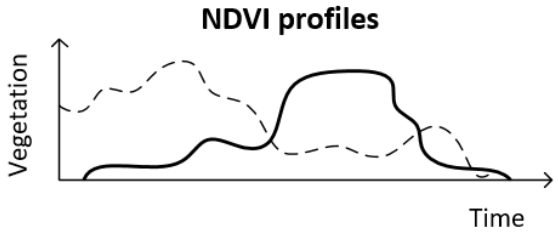
Big Data

Cloud computing

Artificial Intelligence

Checks by Monitoring

- All EU farms
- Regular overviews
- Automated processes
- All-year long monit.ng
- No field visits



Technological shift

Machine learning techniques will be used to learn the patterns of each crop

Benefits:

- Low error rate
- Better usage of EU budget

Copernicus for EU Common Agriculture Policy Monitoring

Source data: Food Security Unit D.5 JRC

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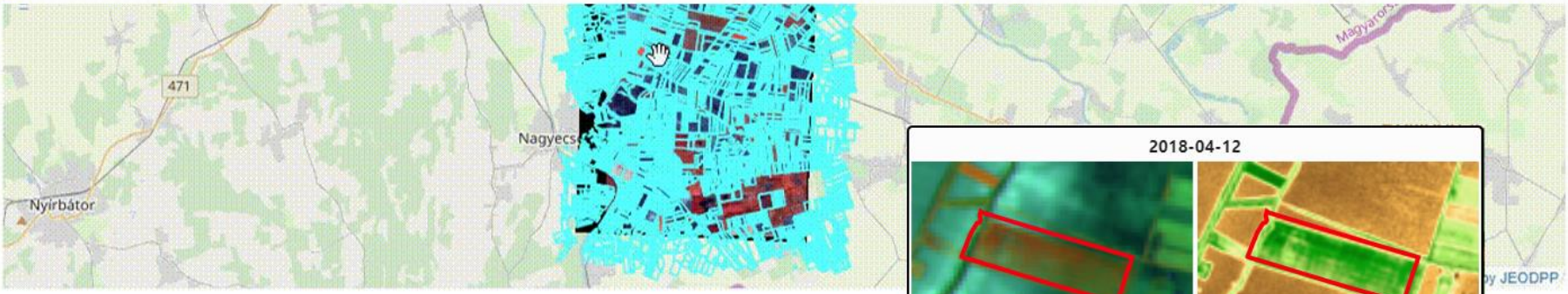
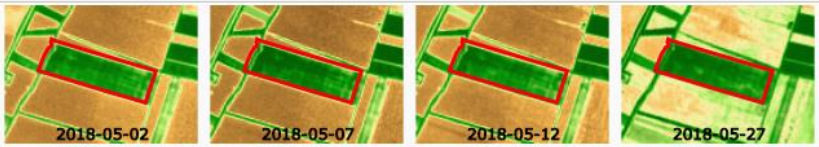
JEODPP The JRC Big Data Platform



Plot | Map | Imagettes | Sentinel2 display | Histograms

Show Stddev ☑ Show Tooltip ☑ Height: medium Dates interval: gg/mm/aaaa gg/mm/aaaa Values interval: 0 1 Save animation

Month	Images
2018 MAY	
2018 AUG	
2018 SEP	

Forest fires monitoring

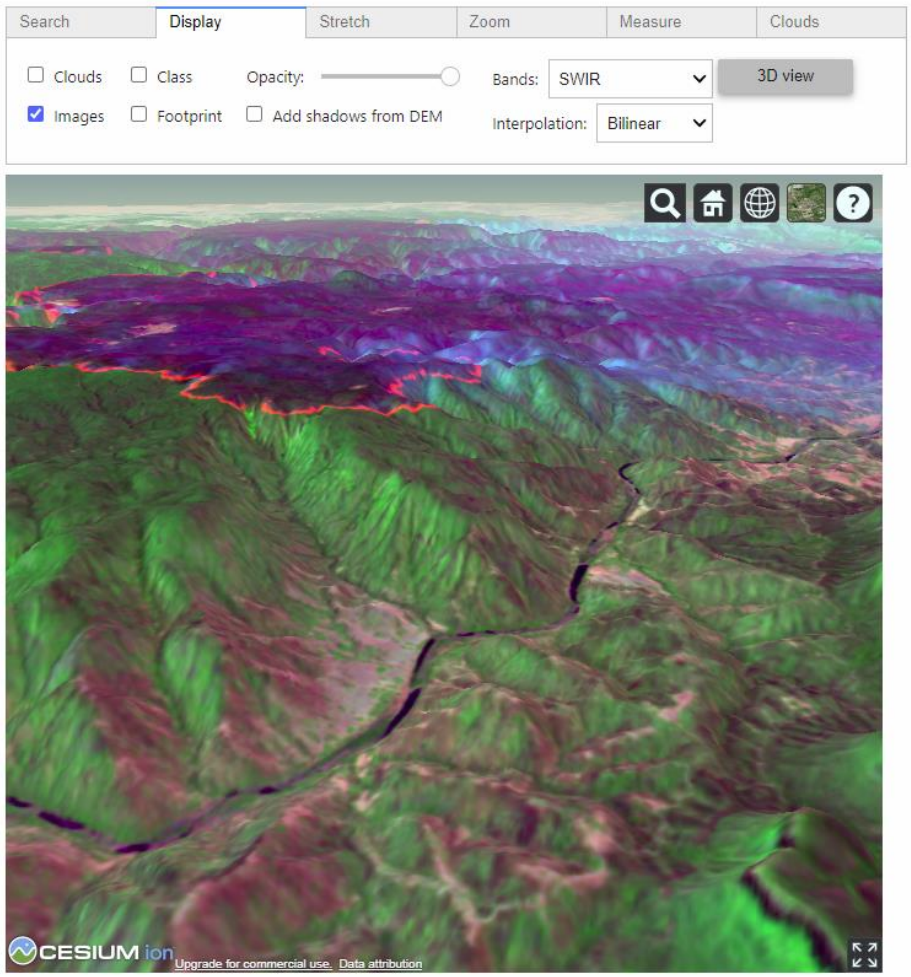
Use Sentinel2 satellite images to monitor forest fires events

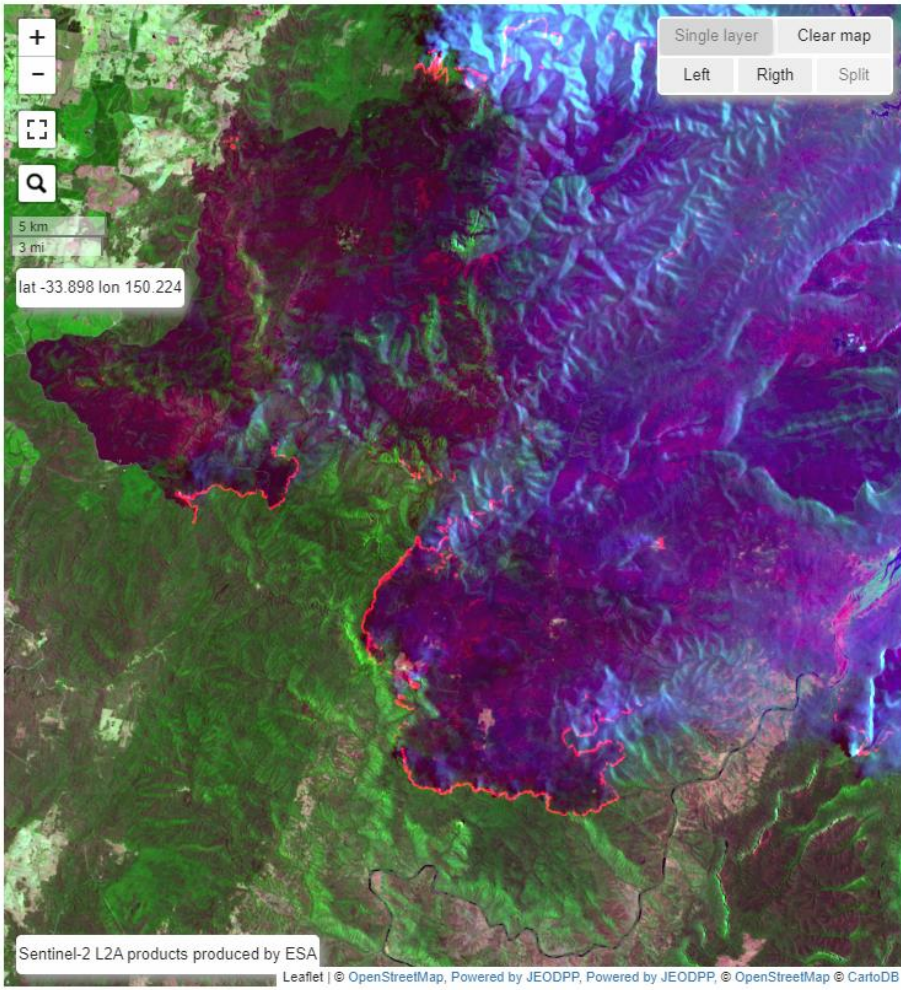
Thermal band combination highlights the fire fronts

2D/3D combined views thanks to **ipyleaflet** and CESIUM

Voilà dashboard on Blue Mountains fires (Dec. 2019)

Blue mountains fires (Australia, 2019)





Monitor COVID-19 spreading in Italian provinces

Display: Total cases | Daily cases

Mode: Absolute values | Per 1.000 inhabitants

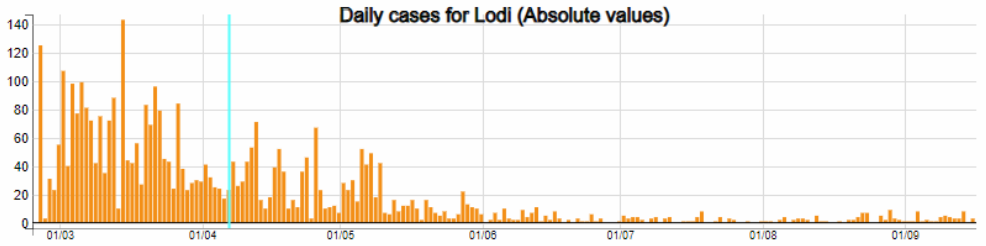
European Commission Joint Research Centre

JEODPP The JRC Big Data Platform

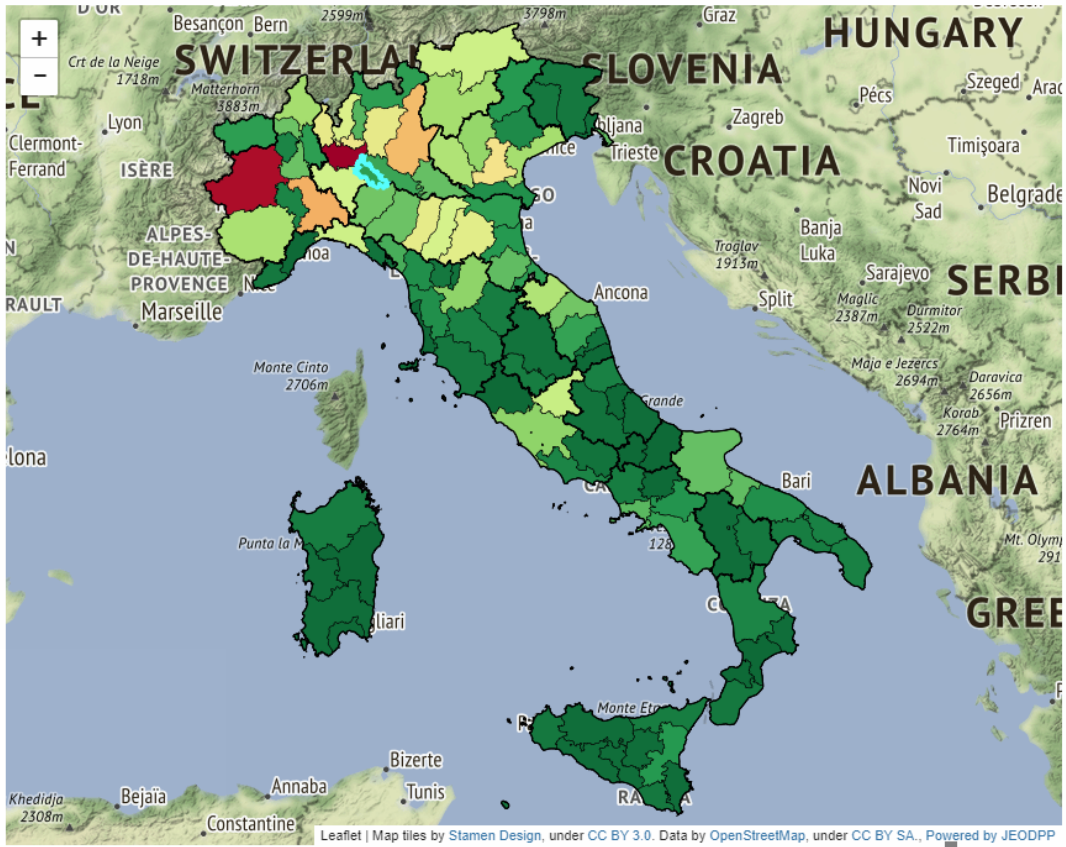
Color schema for legend: Green to Red ☐ Exponential

Max value for legend: 200

Legend on Daily cases (Absolute values)

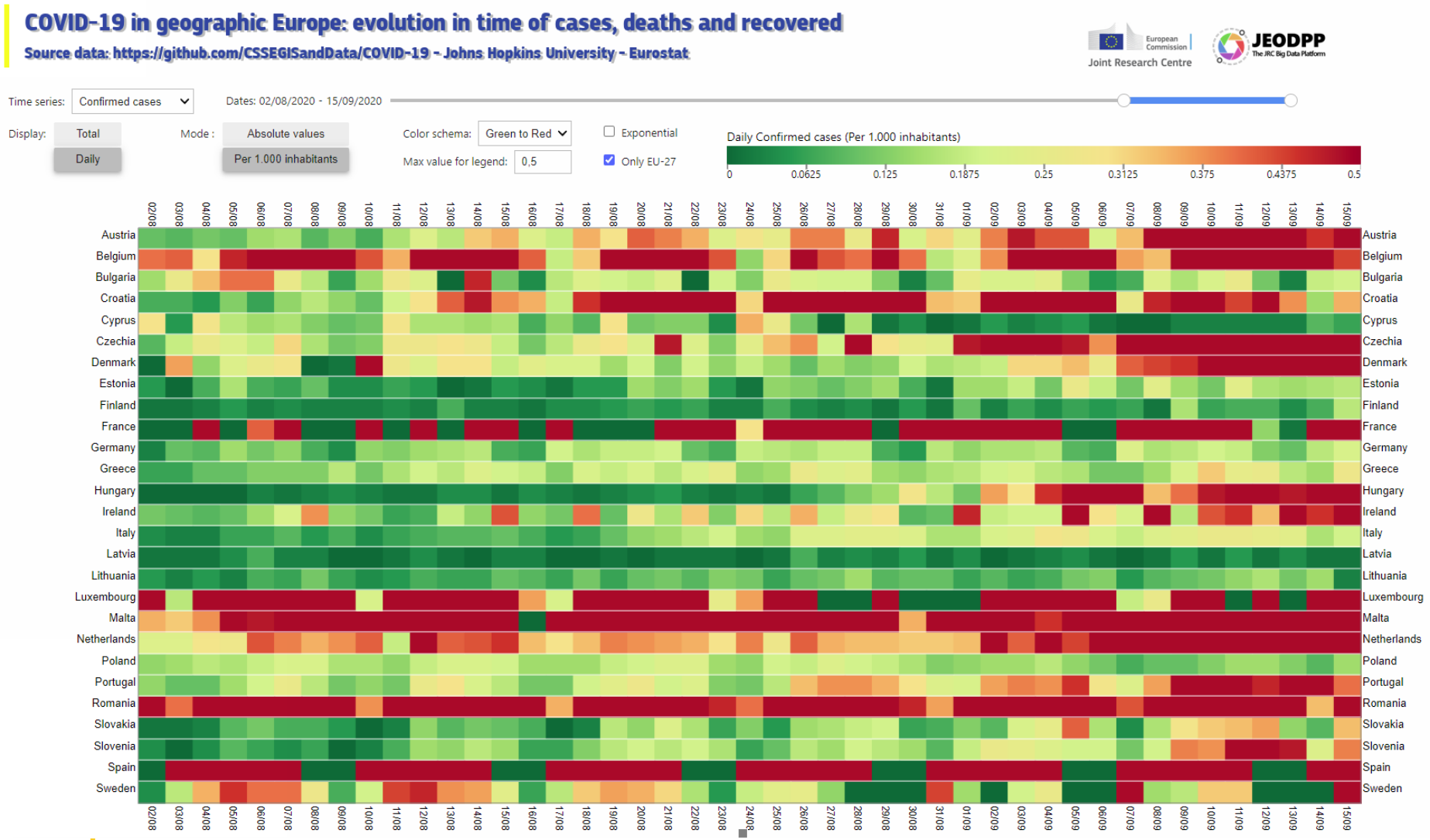


Date: Increment: 1 -1 +1 06/04/2020

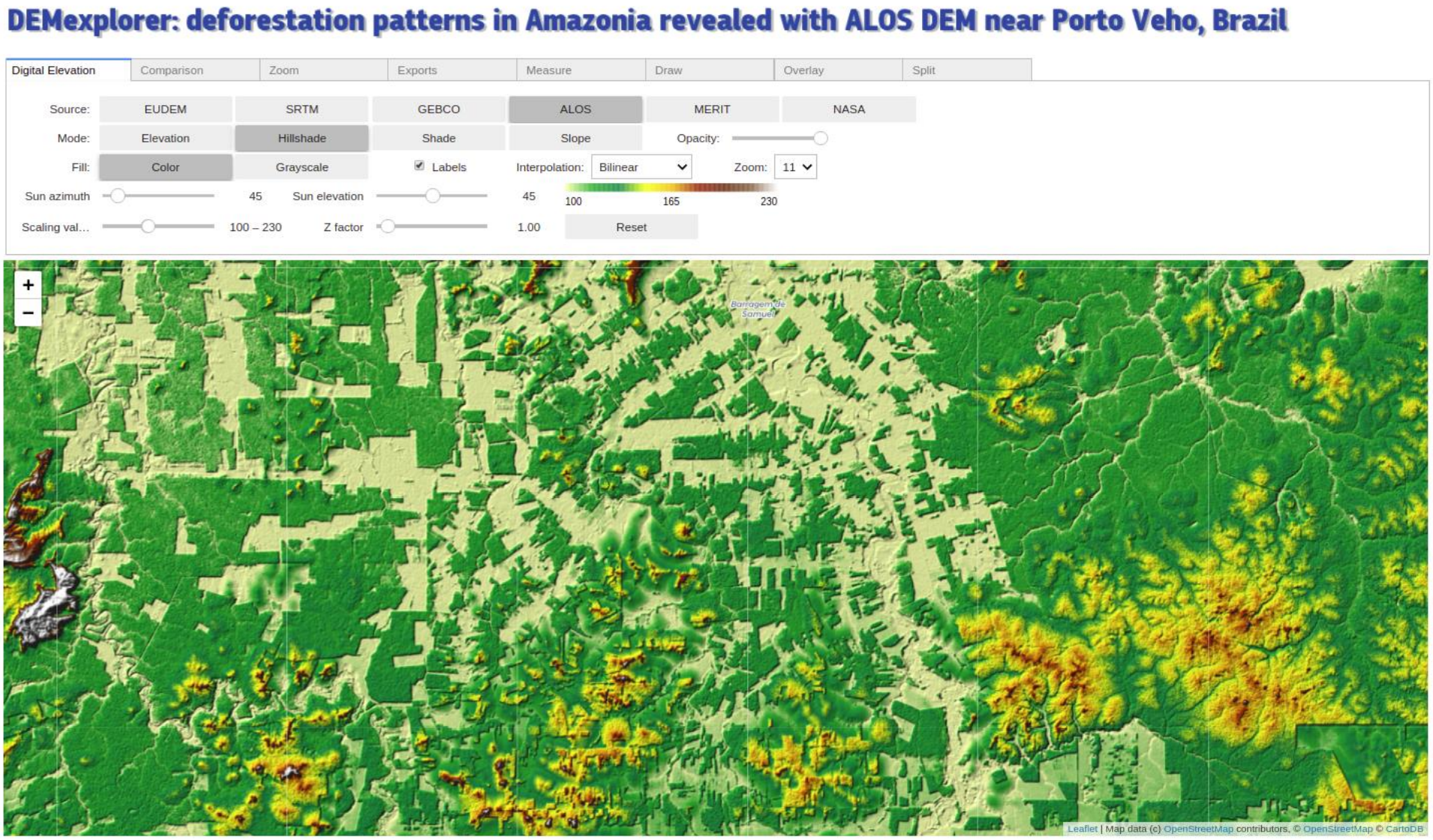


Province	Region	Daily Cases	Population	Casesx1000	Pos
Cuneo	Piemonte	64	588559	0.10874	19
Trento	P.A. Trento	63	539898	0.11669	20
Verbano-Cusio-Ossola	Piemonte	63	159159	0.39583	21
Venezia	Veneto	62	853552	0.07264	22
Vicenza	Veneto	57	863204	0.06603	23
Roma	Lazio	55	4355725	0.01263	24
Firenze	Toscana	54	1013260	0.05329	25
Ancona	Marche	45	472603	0.09522	26
Piacenza	Emilia-Romagna	44	286781	0.15343	27
Vercelli	Piemonte	42	172307	0.24375	28
Parma	Emilia-Romagna	42	450256	0.09328	29
Foggia	Puglia	41	625311	0.06557	30
Mantova	Lombardia	40	411762	0.09714	31
Barletta-Andria-Trani	Puglia	39	391224	0.09969	32
Trieste	Friuli Venezia Giulia	38	234638	0.16195	33
Forli'-Cesena	Emilia-Romagna	38	394185	0.0964	34
Napoli	Campania	36	3101002	0.01161	35
Lecco	Lombardia	34	337249	0.10082	36
Massa Carrara	Toscana	31	195849	0.15829	37
Cremona	Lombardia	27	358512	0.07531	38
Salerno	Campania	25	1101763	0.02269	39
Macerata	Marche	25	316310	0.07904	40
Sondrio	Lombardia	23	181403	0.12679	41
Aosta	Valle d'Aosta	23	126202	0.18225	42
Lodi	Lombardia	23	229765	0.1001	43

Synthetic view of COVID-19 spreading in Europe

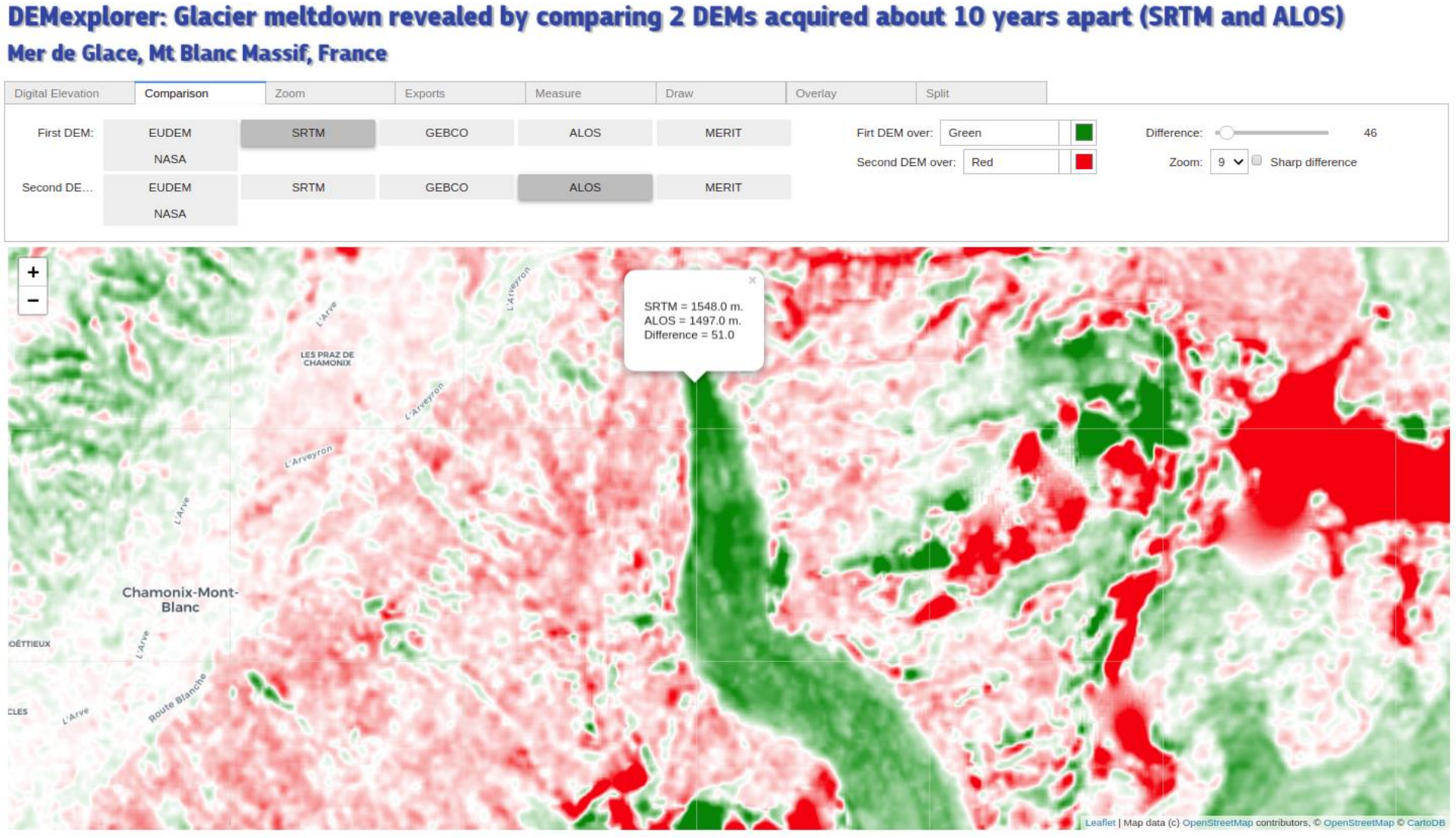


Climate change and European Green Deal



Climate change and European Green Deal

Climate change and European Green Deal



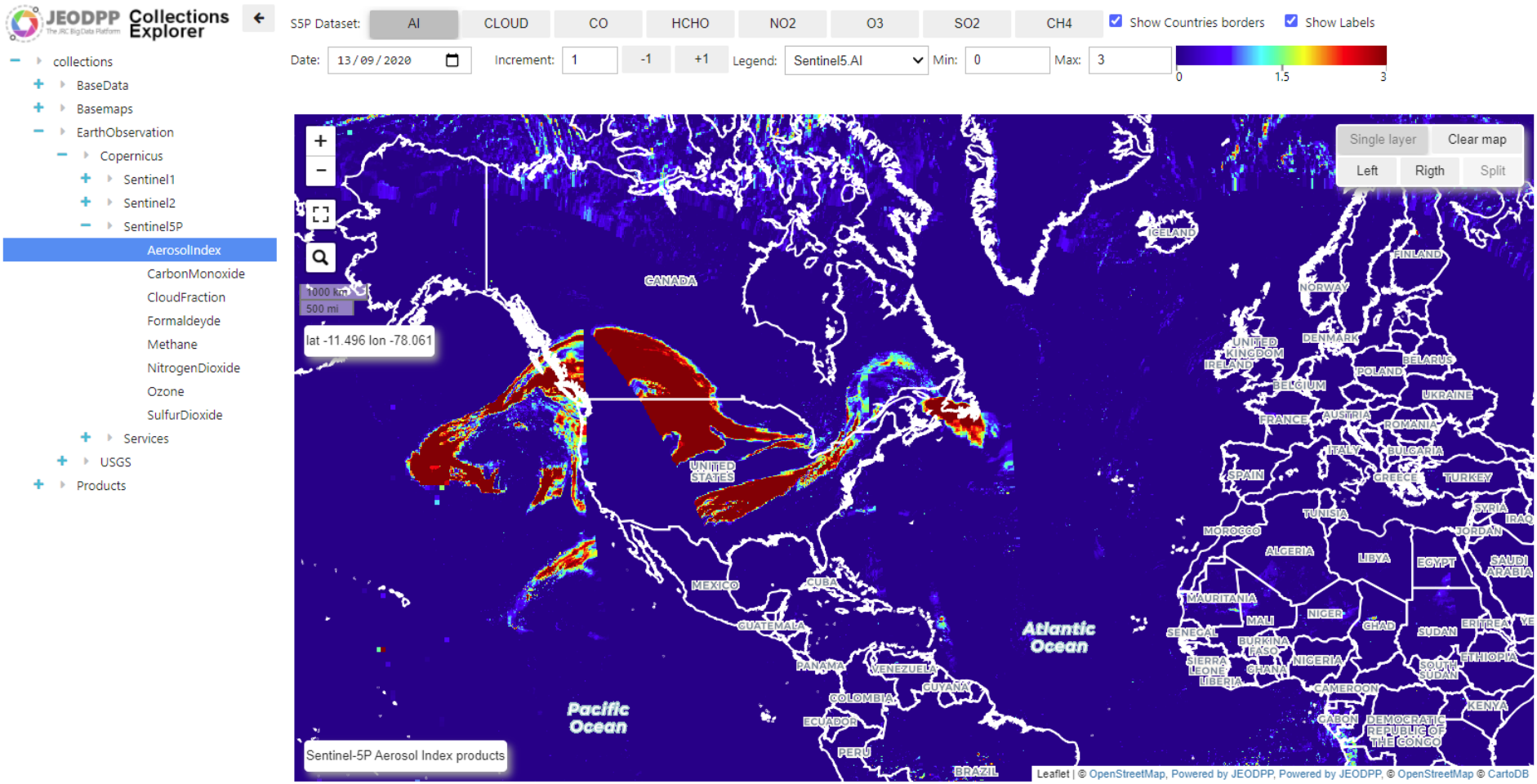
Monitoring air quality

Sentinel5P is the first Copernicus mission dedicated to monitoring our atmosphere

Its main objective is to perform atmospheric measurements with high spatio-temporal resolution, to be used for air quality, ozone & UV radiation, and climate monitoring & forecasting.

It acquires a full globe image each day measuring quantity of CO, NO2, Aerosol, SO2, etc.

Global effects of recent California fires



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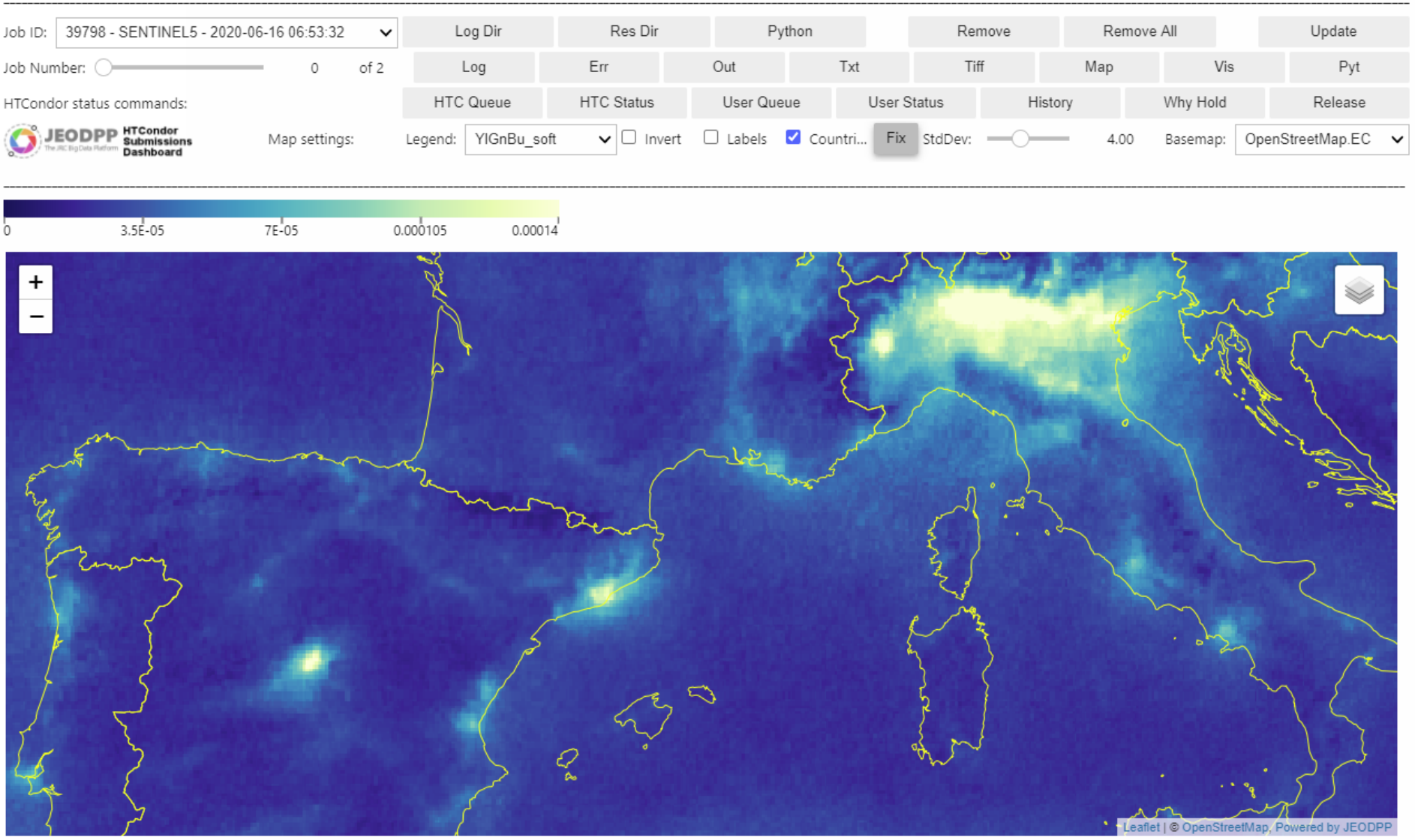
Effects of lockdown measures on air quality



EU expenditure 2007-2019: visual analytics on the multi-annual EU budget

Source data: https://www.europeandataportal.eu/data/datasets/eu-expenditure-and-revenue-2014-2020

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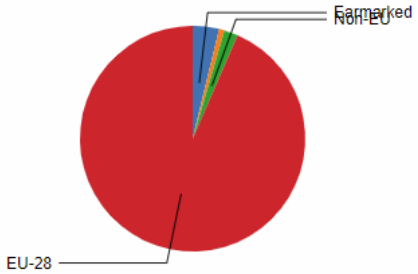
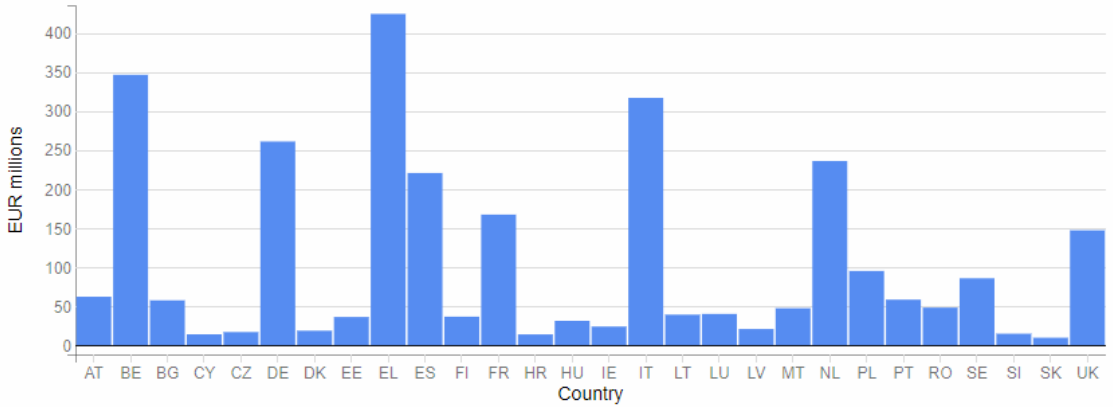
JEODPP The JRC Big Data Platform

Select a year: 2018 -1 +1 Use population data

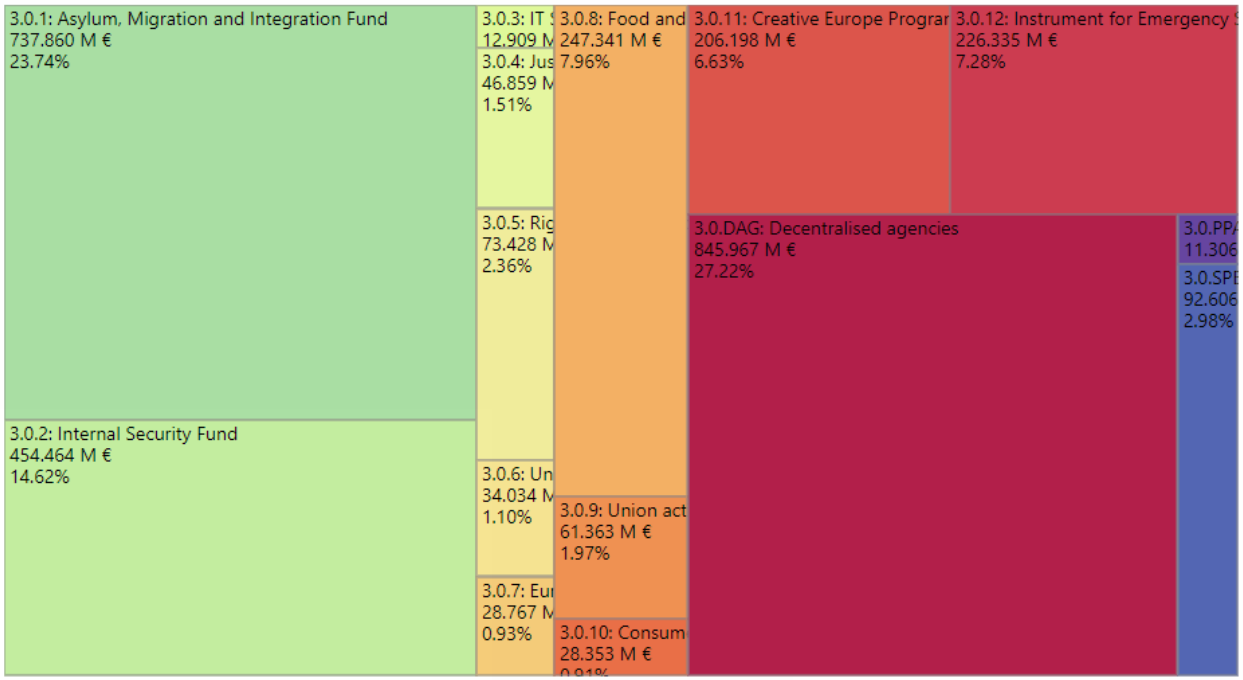
Detail by type/country:

EU
Non-EU
Other
Earmarked





3: SECURITY AND CITIZENSHIP = 3107.790 M €



Expenditure for year 2018:

- Total expenditure
  - + 1: SMART AND INCLUSIVE GROWTH
  - + 2: SUSTAINABLE GROWTH: NATURAL RESOURCES
  - + 3: SECURITY AND CITIZENSHIP
  - + 4: GLOBAL EUROPE
  - 5: ADMINISTRATION
  - 6: COMPENSATIONS
  - 8: NEGATIVE RESERVE
  - 9: SPECIAL INSTRUMENTS

Voilà dashboards are used in

ScienceMesh is the future federated infrastructure developed by CERN and 11 other partner institutions (among which JRC), providing a ubiquitous sync and storage solution for Science, based on Open Source Software and Open Standards.

It will integrate tools aimed at empowering the work of scientists world wide: research environments, notebooks, collaboration and editing tools.

It will enable service providers to deliver state-of-the-art, connected infrastructure and to boost effective scientific collaboration and data sharing according to FAIR principles.

Voilà technology is used inside the project to create dashboards for Earth Observation and High Energy Physics use cases.

Links: cs3mesh4eosc.eu
github.com/cs3org
sciencemesh.io

European Commission

Takeaway

Voilà is an important component of the JRC Big Data Platform: it greatly contributes to generate indicators for policy support and to visualize and analyse complex datasets.

The integrated usage of many widgets allows for the creation of multifaceted applications that connect diverse datasets, geospatial and non-geospatial.

Voilà enables our research group to better engage citizens and other EC directorates and to attract users to the Big Data Platform.

Keep in touch

JRC: ec.europa.eu/jrc Big Data Plat.: jeodpp.jrc.ec.europa.eu

JRC: @EU_ScienceHub Personal: @demarchidavide

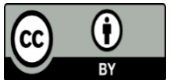
EU Science Hub – Joint Research Centre

EU Science, Research and Innovation

Eu Science Hub

European Commission

Thank you



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