living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

Rapid Action on Covid-19 and EO

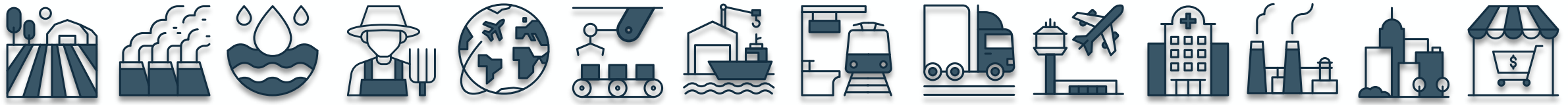
Anca Anghelea, ESA

24/05/2022

Objectives

https://race.esa.int

- Join initiative of ESA EOP and EC DG-DEFIS
- Provide public EO info on the state of European society and economy, with 4 focus areas:
  - **climate, environment, economy and agriculture**
- Using European EO: Copernicus Sentinels and Third Party Missions
- Leveraging on European companies capabilities and using AI powered latest **platforms technology**



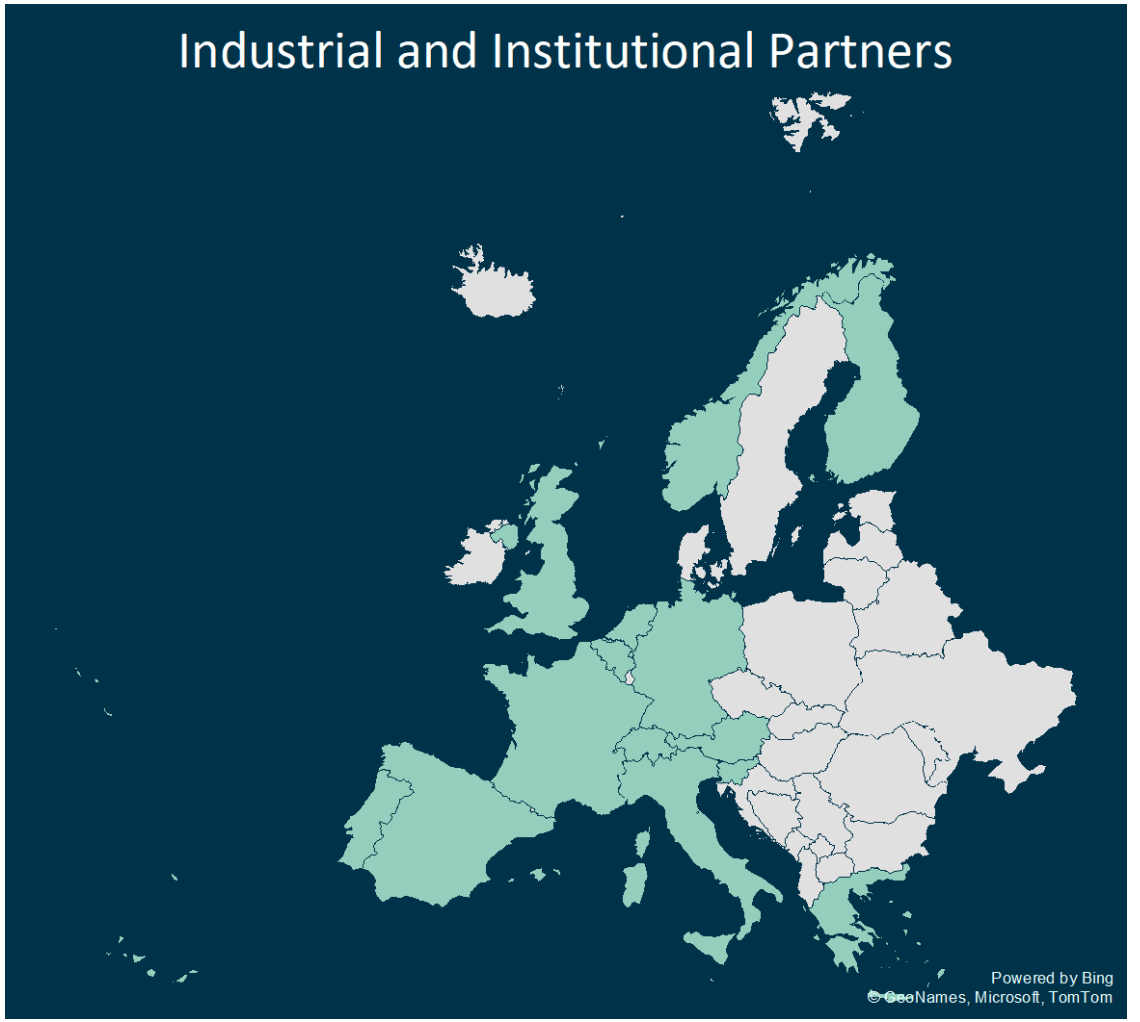
Timeline and Status

- Launched in May 2020 with a suite of core products
- Products by ESA, European Industry, Copernicus Services
- Continuously updated throughout 2021 and 2022
- Expanded with new data and tools
- Open for community contributions
- Used in training and education in EO

60 Agriculture	10 Water Quality
56 Health	6 Combined indicators
238 Air Quality	249 Economy

Main Achievements (1/3) – Collaboration

- 40 industrial and institutional contributors
- Copernicus Services – CAMS, CMEMS, C3S
- Participation of the scientific community



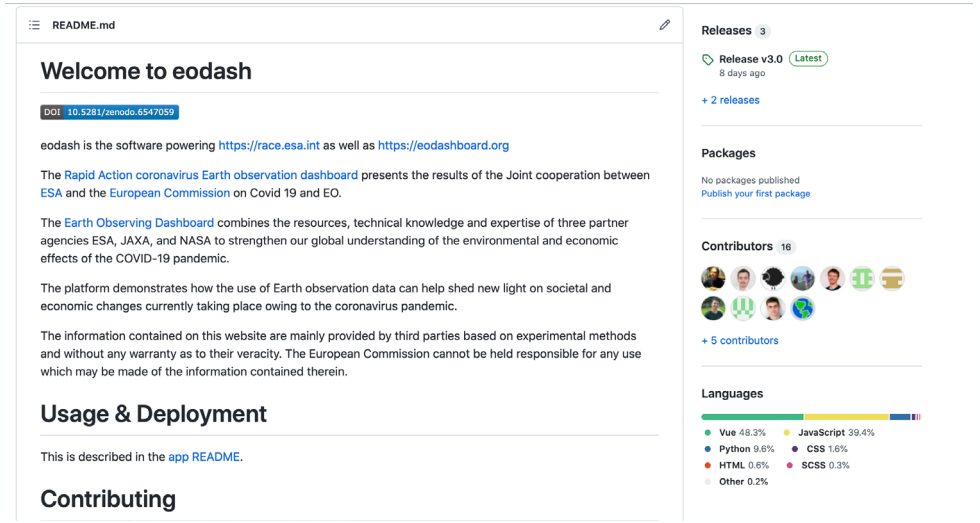
Main Achievements (2/3) – Open Science

- Open EO Data and information (e.g., Copernicus)
- Open Source Library
- Open resources for Training and Education

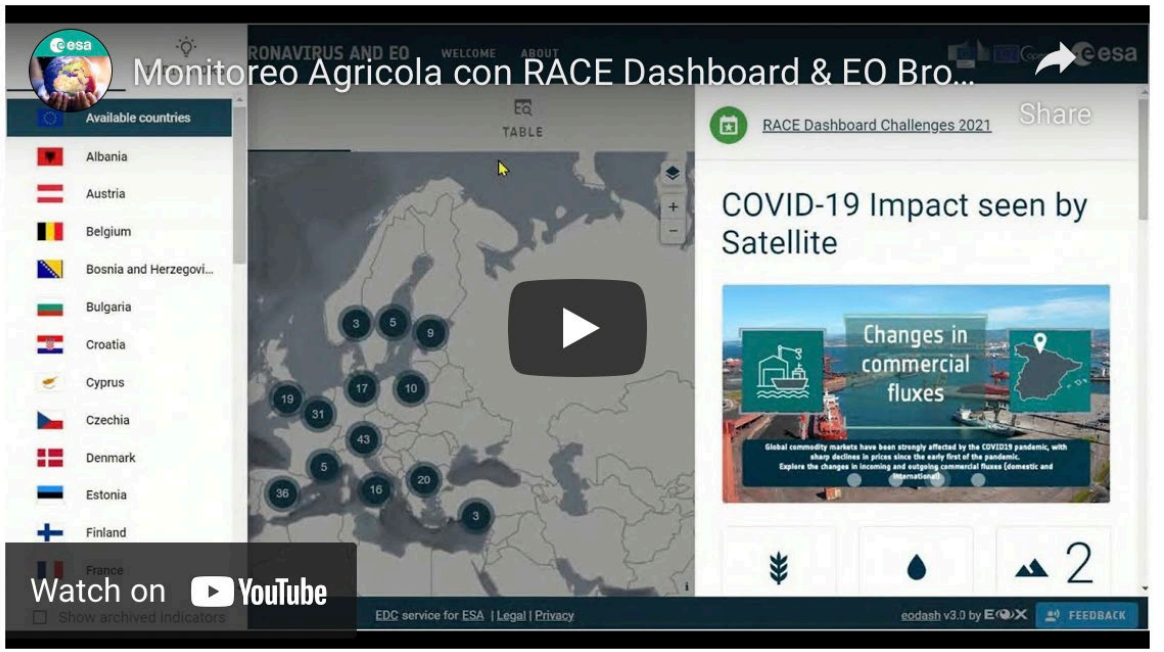
LPS 2022

- **Open Science Agora (Thu 08:30)**
- **Demo @OEF (Thu 14:00)**

Hands-on tutorial – IGARSS 2022



https://github.com/eurodatacube/eodash

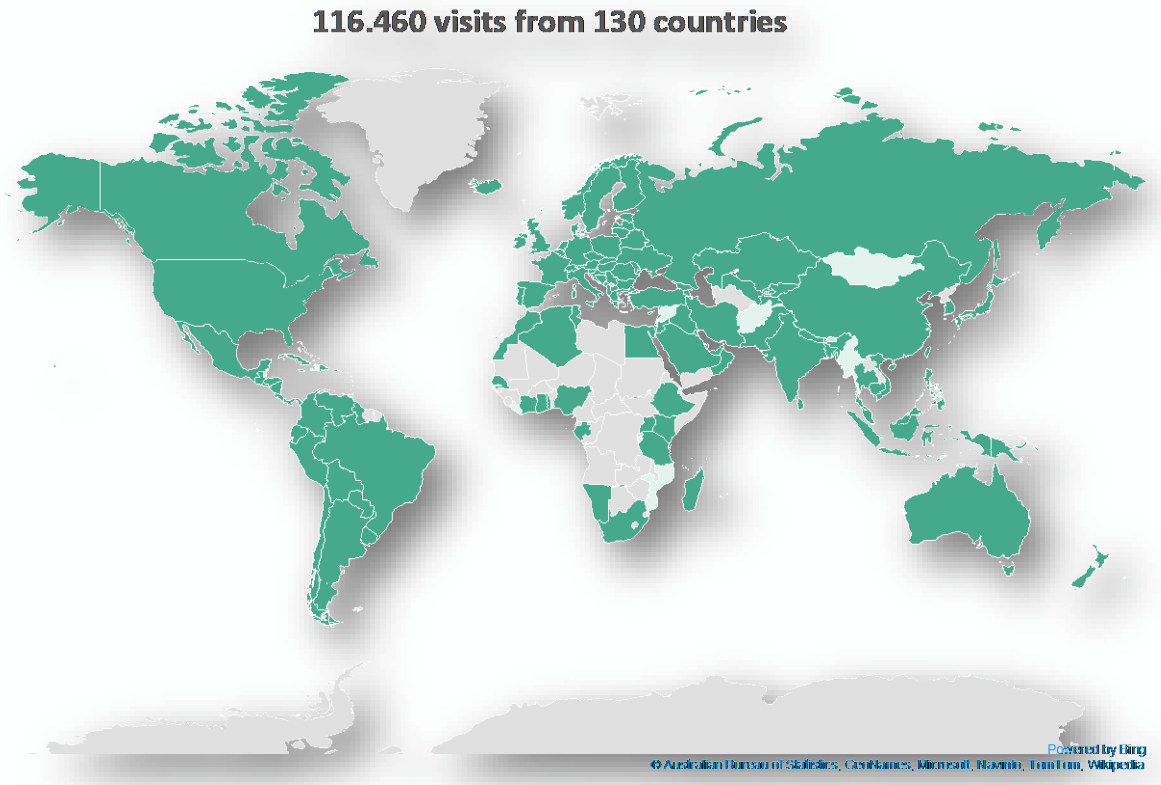


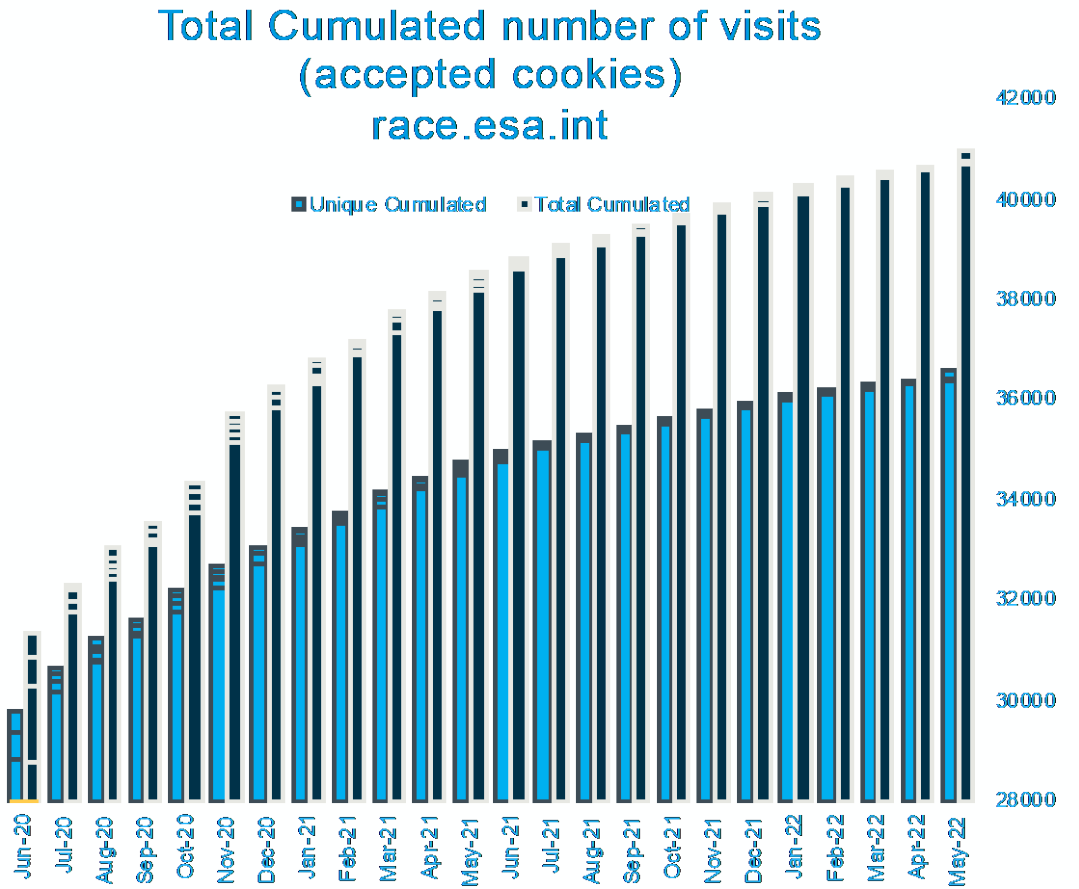
Main Achievements (3/3) – Innovation

Detection of trucks on motorways/primary roads in Sentinel-2 imagery

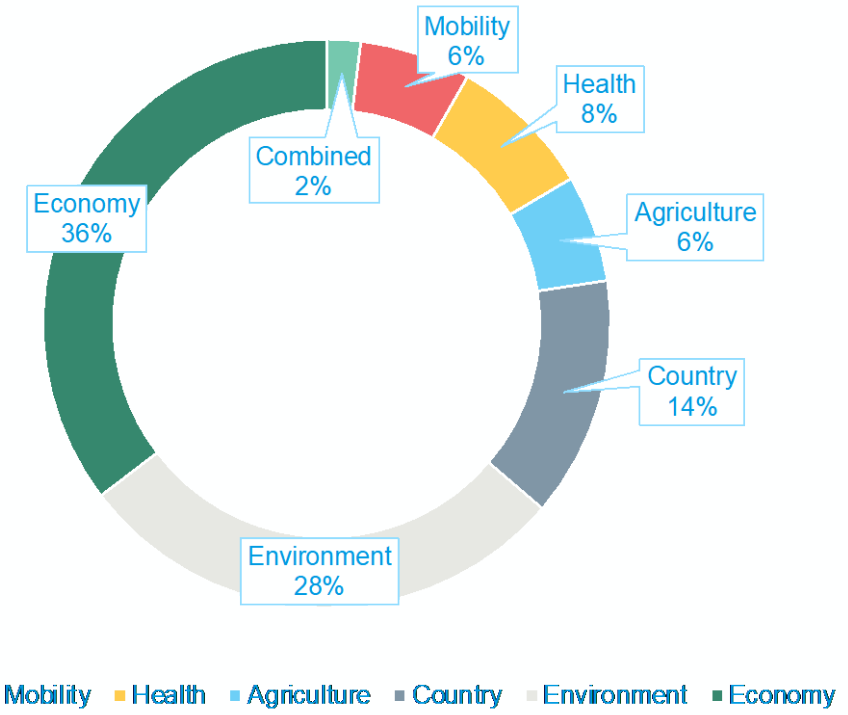
- Framework for Rapid Innovation
- Flexibility for Exploratory R&D
- Agile Development with Design Thinking
- Open for public contributions

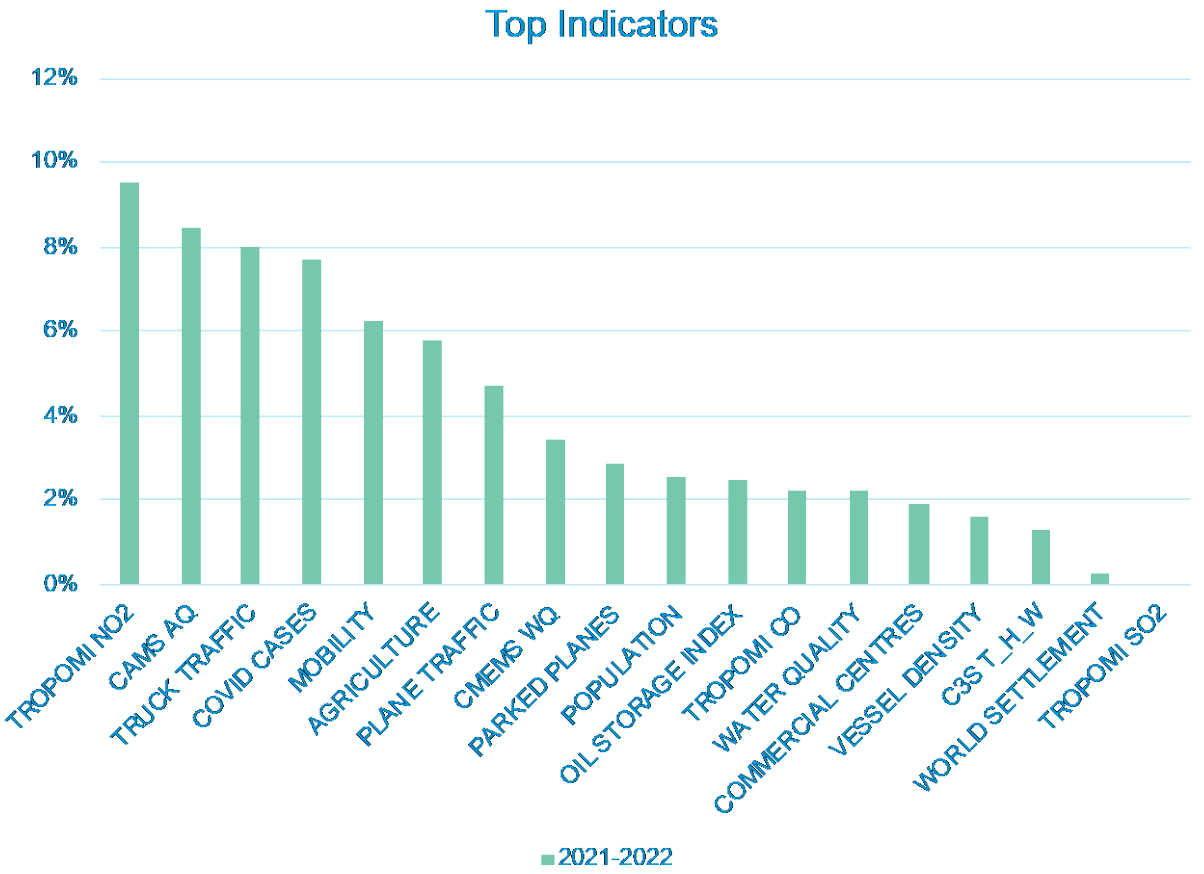
User Statistics (1/2)





User Statistics (2/2)



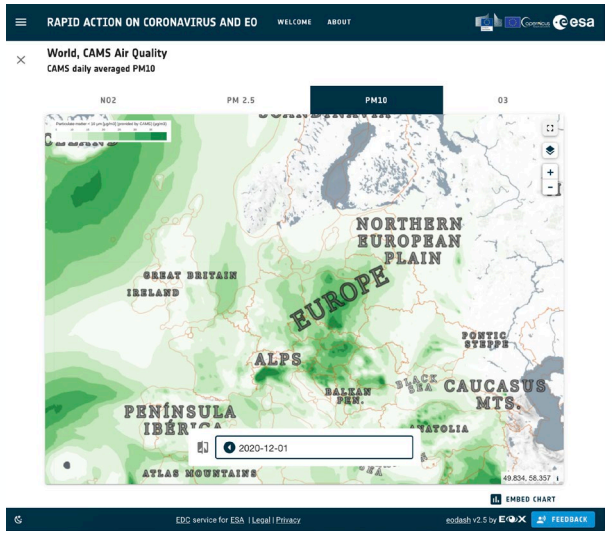


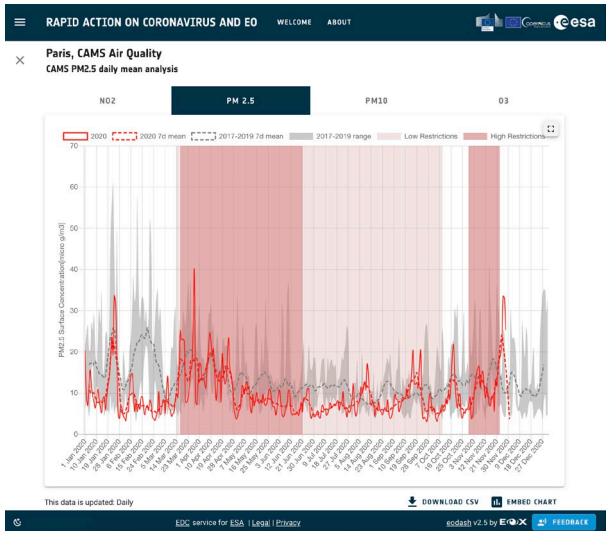
Data Sources

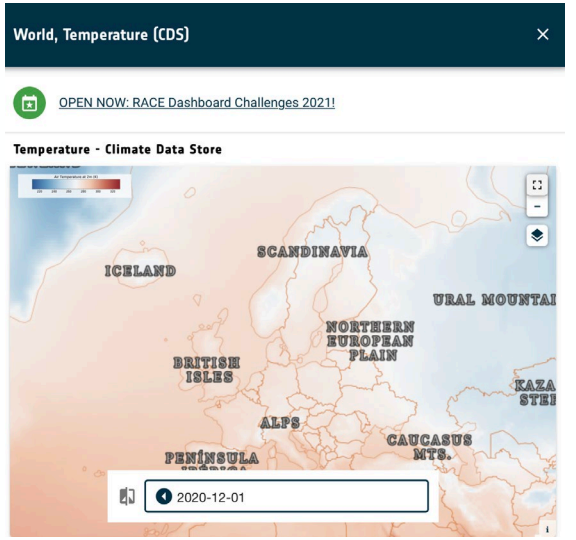
Copernicus Sentinel-1	Copernicus Sentinel-2	Copernicus Sentinel-3	Copernicus Sentinel-5p	Third Party Mission Data	Non-EO Data: AIS, Mobile, Mobility, OSM, Our World in Data, Oxford, etc.

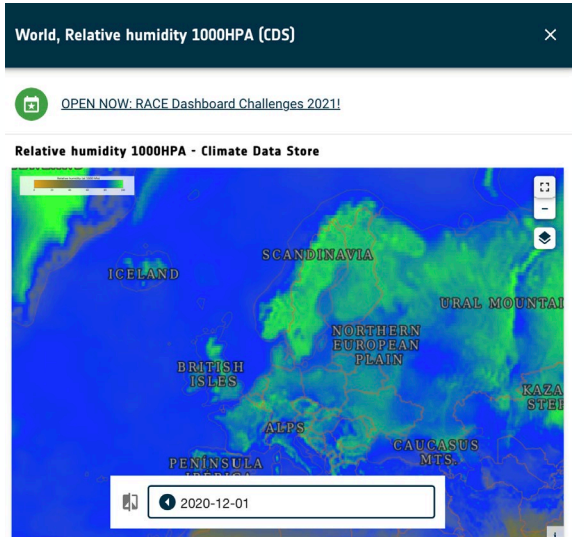
Copernicus Services Data (1/2)

- CAMS - NO2, PM2.5, PM10, O3
  - 50 European Cities
  - Time Series and Maps
- C3S – Temperature, Humidity, Wind







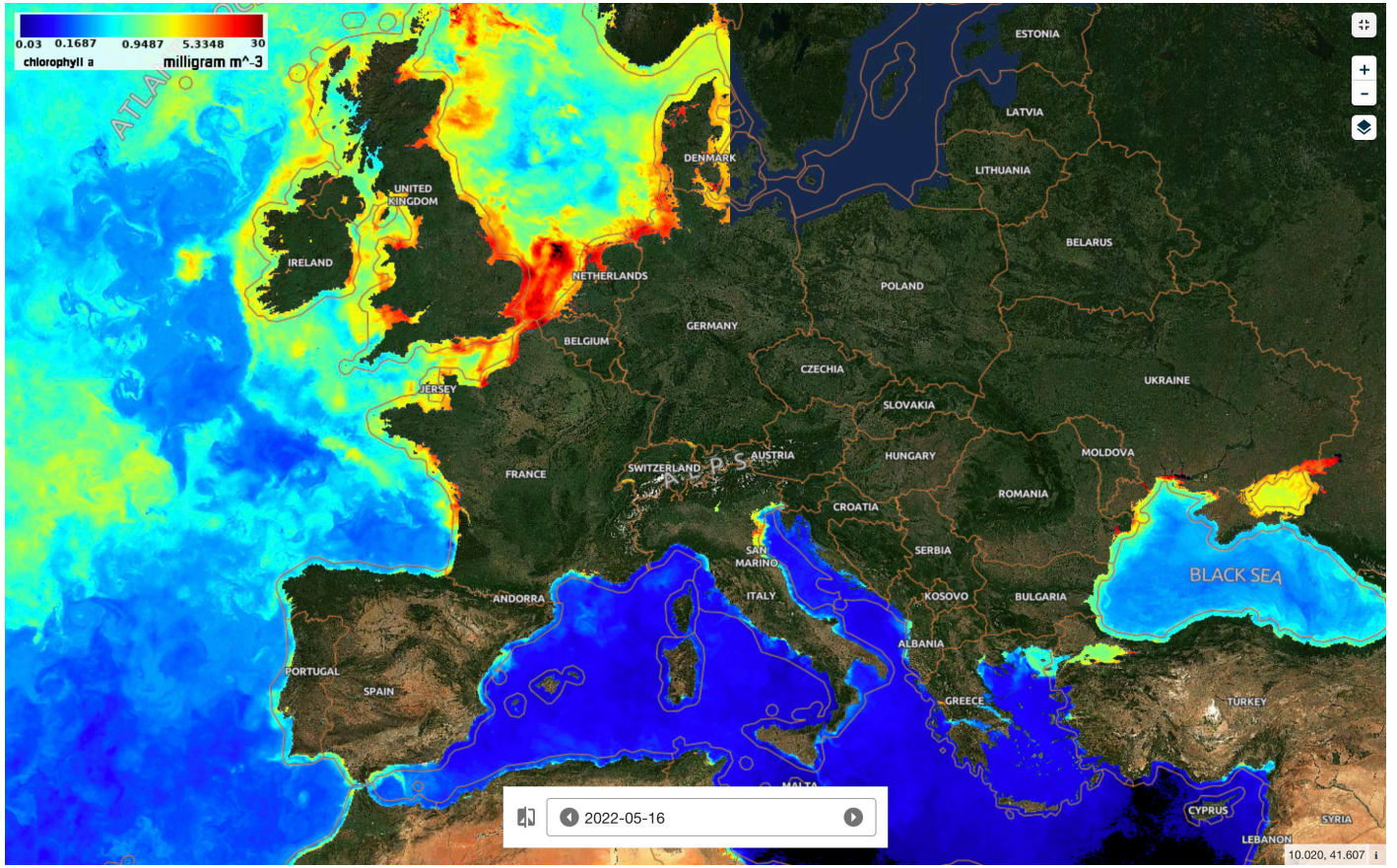


https://atmosphere.copernicus.eu/

https://climate.copernicus.eu/climate-information-support-covid-19-research

Copernicus Services Data (2/2)

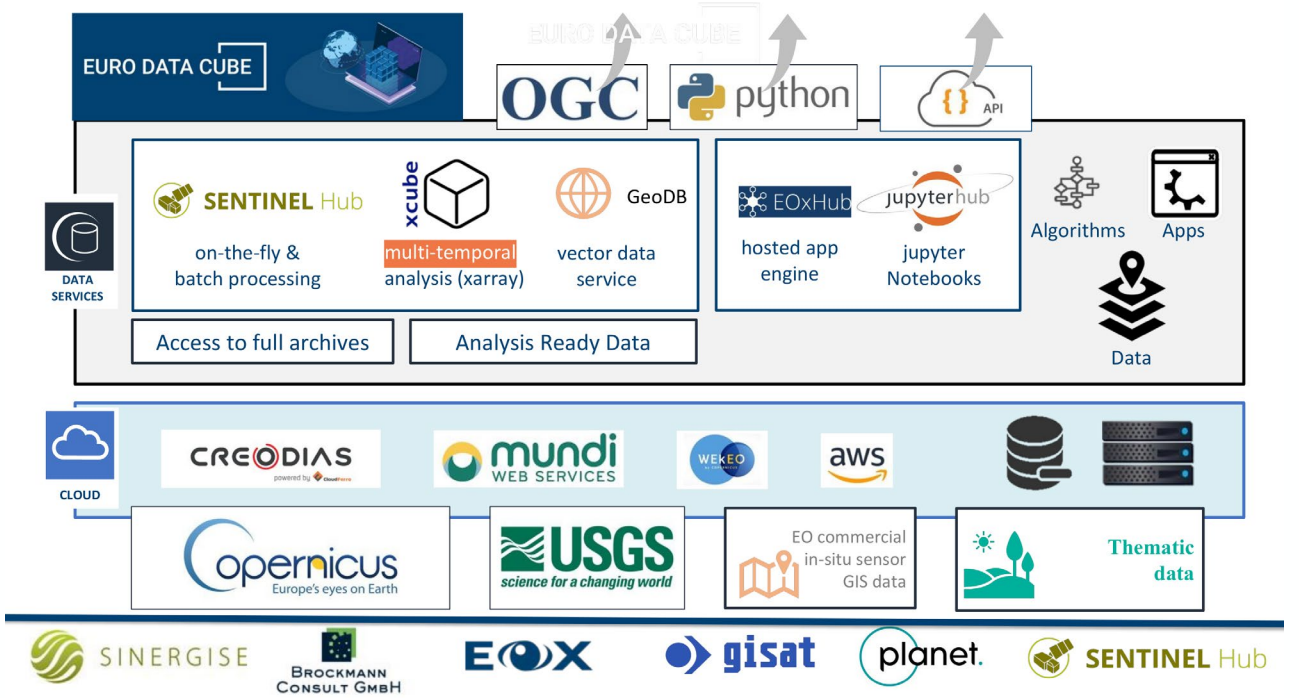
- CMEMS daily interpolated gap-free Level-4 chlorophyll concentration
  - Mediterranean, Black Sea, Atlantic



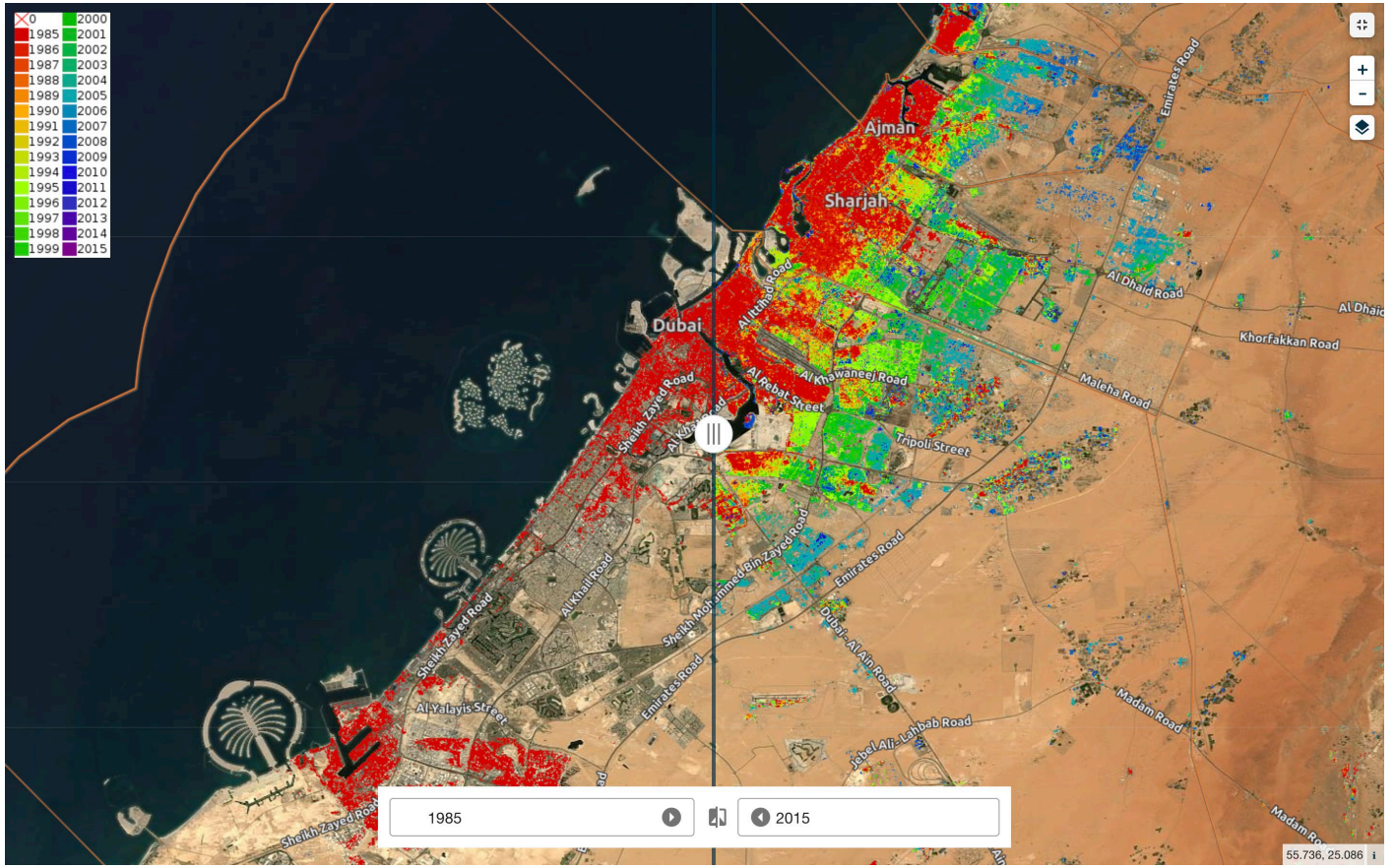
Source: https://marine.copernicus.eu/

Technologies

- Euro Data Cube
  - SentinelHub API
  - geoDB
  - xcube
  - EOXHub
- OGC Web Services
- Custom APIs made available by industrial data providers
- Open Source EODASH library developed for front-end
- Open Layers
- Leaflet
- Vue.js



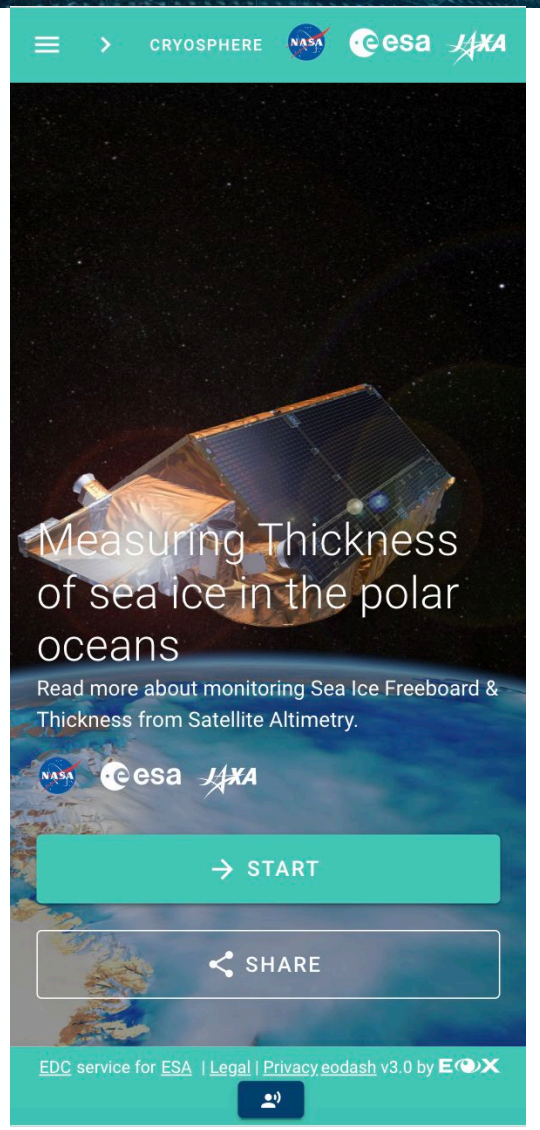
Features (1/2)

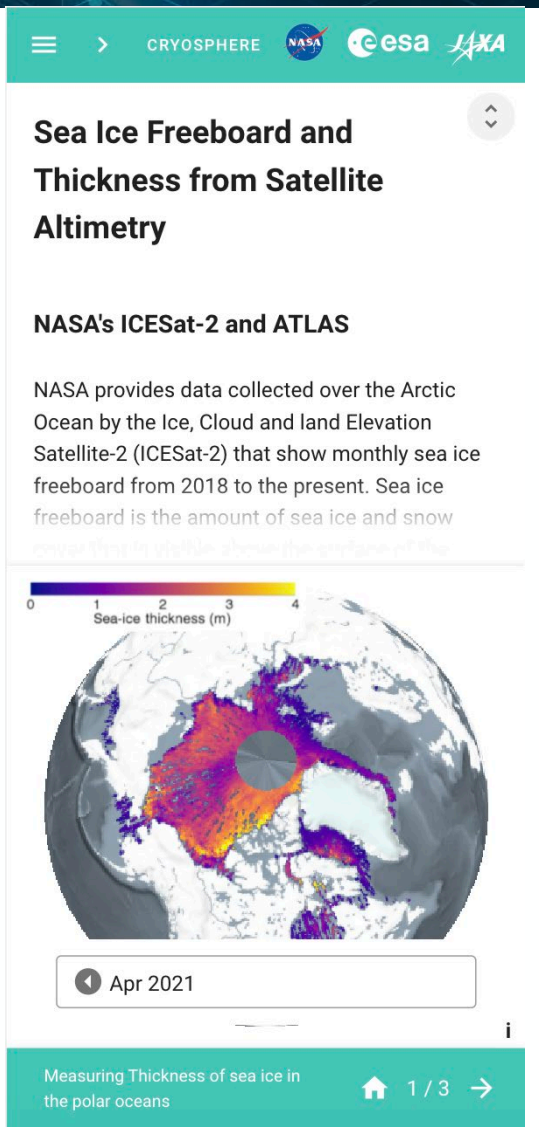


- DATA EXPLORATION
  - Versatile visualisation options
    - 2D maps / 3D globe views (used in the NASA-ESA-JAXA EO Dashboard)
    - Custom charts for indicators
  - Map annotations with vector data overlays
  - Multiple map layers
  - Map comparisons at different times
  - Tabular data download
  - Analytics on User defined AOIs

Demo Thursday: Collaborative Storytelling with EO Dashboard, 14:00

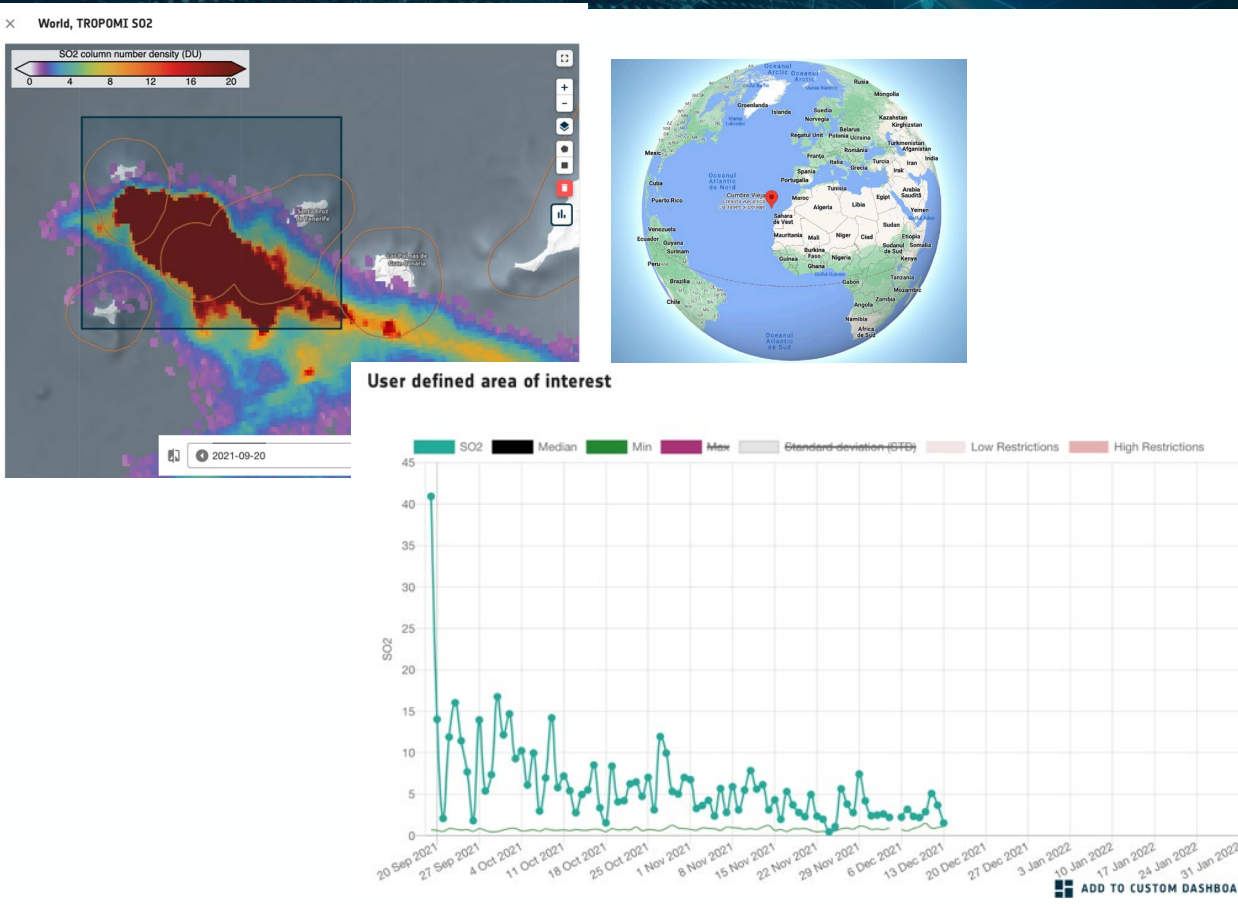
Features (2/2)





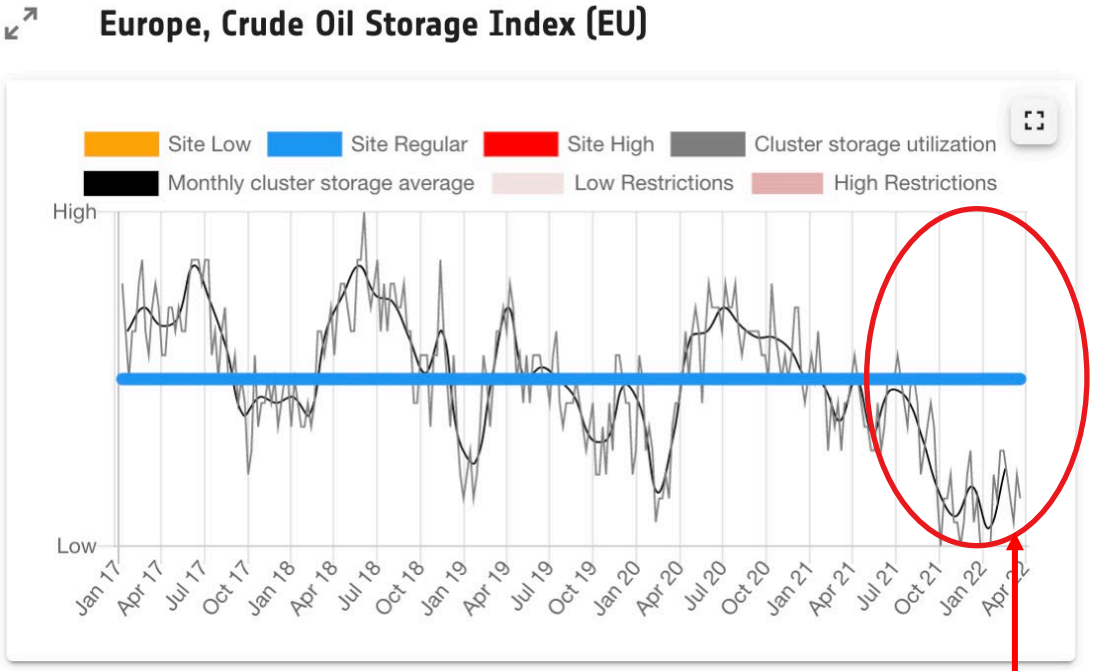
- COLLABORATIVE STORYTELLING
  - Custom-dashboard
    - Add selected indicators to custom view
    - Customise layout
    - Customise text and images
    - Combine with external sources
    - Embed external elements
    - Support for markdown
    - Real-time collaboration on editing
  - Deploy as story (available on NASA-ESA-JAXA EO Dashboard)

Example Insights – Analytics



Volcanic SO2 observed by Sentinel 5p TROPOMI

- Variation of SO2 emissions during the eruption of the Cumbre Vieja eruption in October 2021

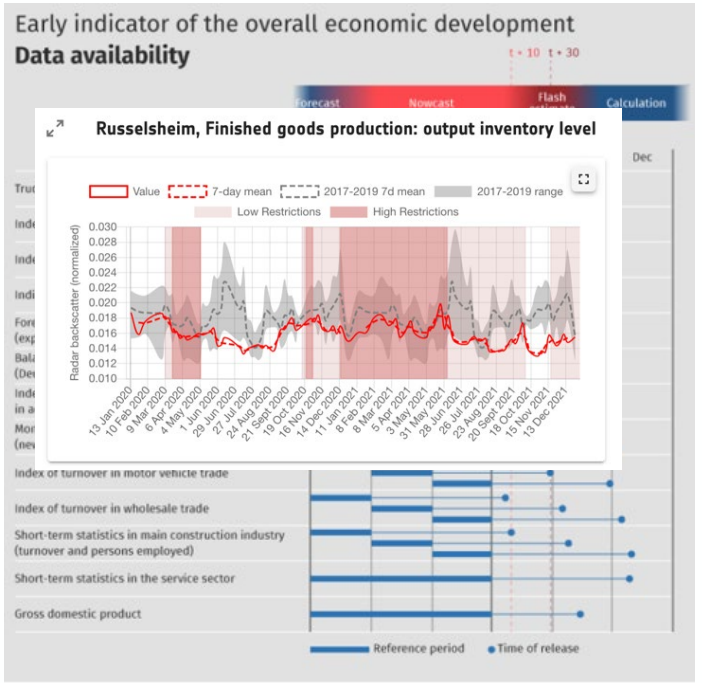


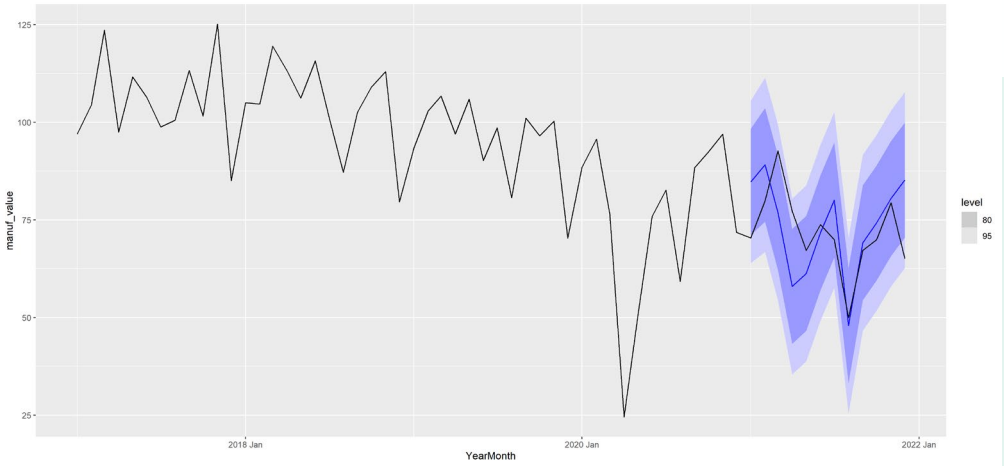
Crude Oil Storage Index – provided by OILX

- Based on Sentinel-1 , Sentinel-2, AIS and other data
- Captures the shortage of crude oil availability in Q1 2022

Example Insights – EO for GDP nowcasting

- **Accelerate early GDP estimation – Analysis by DESTATIS**
- **Question:** What satellite data can be used to calculate products that support early GDP estimates?
- **Approach:** Comparison of satellite-derived measures from RACE with the DESTATIS Production index car manufacturing





Forecasting:
Used RACE indicator and historical data of the production index to forecast data for 2021 (blue), and compare with actual values

Results :

- 2017-2020 period → r = 0.60
- 2017 – 2021 period → r = 0.8

Change rate detection analysis:

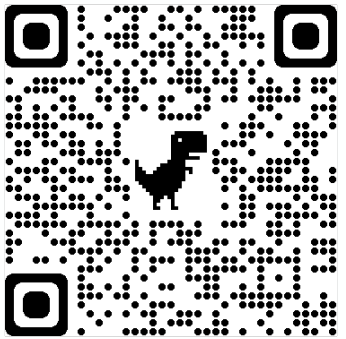
- 2018-2021 period → r = 0.65

Future Steps

- RACE created context for innovation and demonstrated:
  - New ways of collaboration and engagement, e.g. with **Copernicus Services** on use of new technologies, **coordination** among 40+ contributors (scientists, industry, Copernicus Services, EC, ESA)
  - New ways to define EO application with **community** contributed ideas
  - Reliability and maturity of European **technology, having maximised reuse and efficiently managed components integration**
  - Effectiveness of product development **methodology (Agile)**
  - **Open Science** – transparent, reproducible, accessible, inclusive

Next steps – building on this experience and model, enhancing Open Science, collaboration and consolidating a framework for innovation

https://race.esa.int



Thank you!