

Current status and thoughts on a potential roadmap for improving end-user uptake of Earth Observation and Copernicus data services

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Agenda

- Current status of Earth modelling and Earth Observation data
- DIASes overview
- Existing projects and initiatives
 - AI4Copernicus
 - EO4EU
 - DestinE
 - EWC
- Summary

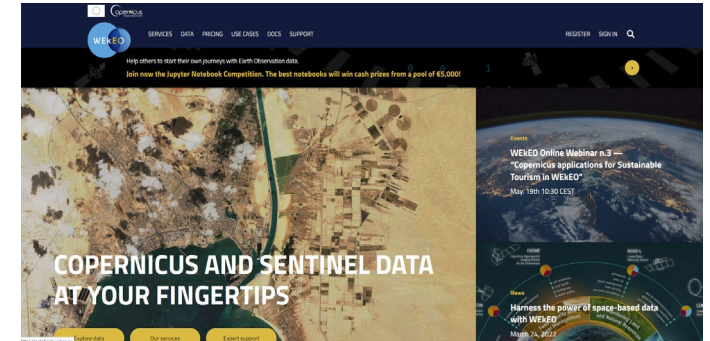
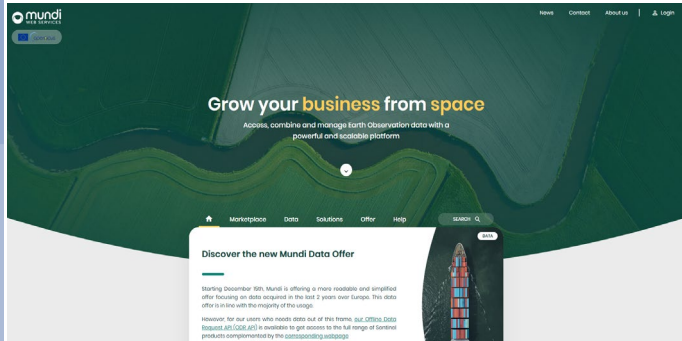
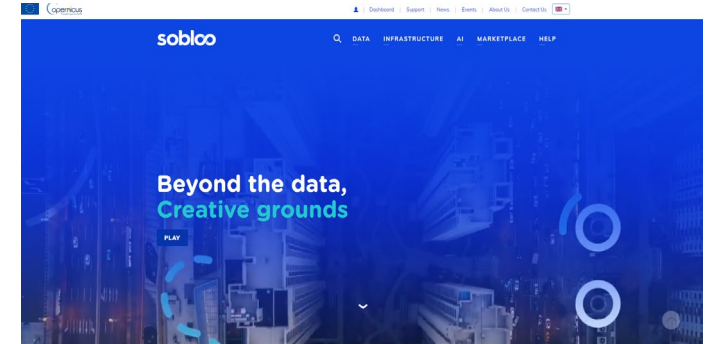
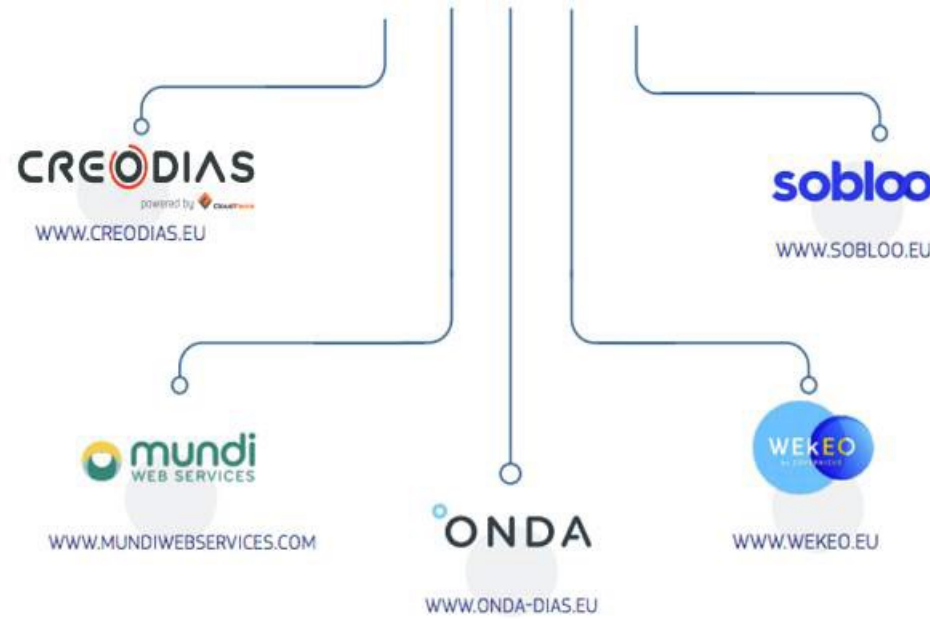
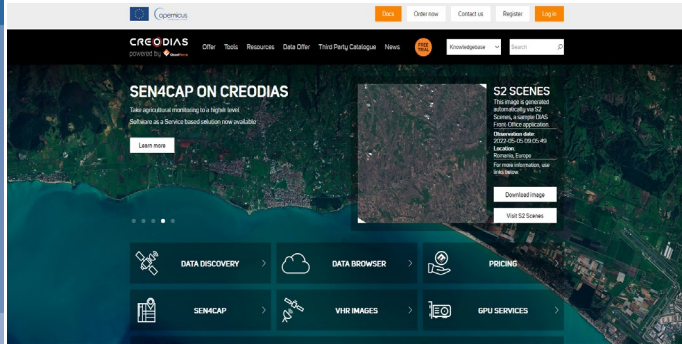
Earth modelling and Earth Observation data (1/2)

- Rapid growth of Earth Observation (EO) data (processed satellite, forecast data etc) especially in the last decade.
- Development of analytical theories and toolset.
- Wide range of practical applications covering land, maritime, climate change and atmosphere composition monitoring.
- Comprehensive and systematic structuring and processing of this data
- Valuable knowledge has helped us model and predict natural processes, improve Atmospheric, Marine and Land monitoring as well as understand the complex dynamics of our planet's environment.

Earth modelling and Earth Observation data (2/2)

- Current EU data services and repositories offer EO data of staggering volume and diversity.
- EO data services like Copernicus and Weather Services, Galileo, European Geostationary Navigation Overlay Service (EGNOS) already provide a significant amount of invaluable EO based data that is currently being used by many organizations and SMEs to deliver their value-added services.
- Data access and use are yet to fully spread beyond EO experts and scientists to the wider industry, academia.
- There is vast potential for increasing awareness and uptake of data and information products through enhanced data access
- The role of projects and initiatives offering cloud infrastructures for processing Copernicus data and information like DIAS, European Weather Cloud, Destination Earth and some related EC Research and Innovation Action (RIA) projects like AI4Copernicus and eo4eu.

Copernicus Data and Information Access Services (DIAS)



DIASes overview

- Serve their main objectives
 - Provide access to Copernicus data and services
 - Provide cloud infrastructure “close” to the data
 - Visual representation of the available data
 - Provide professional services for tailored cloud processing solutions and provided tools.
- Some key points
 - Each platform provides different user experience (in terms of data access, data catalogue, data discovery and visualisation, business model of the offered services, different costing model etc) and different APIs
 - Part of the first phase of DIASes =>try out different models
 - Data semantic annotation/enrichment & data mining capabilities are barely offered
 - Query-by-image & query-by-text functionalities for mining EO data do not currently exist
 - Image captioning is the process of providing a textual description of a given image
 - Data fusion mechanisms : data mappings for heterogeneous data fusion, gap filling and quality enhancement.
 - Cloud infrastructure support with GPUs and Kubernetes
 - Introduction and support of new toolsets

DIASes overview

- User uptake and future sustainability are key concerns.
- Synergies with other initiatives should be explored further
 - European Open Science Cloud (EOSC)
 - DestinE
- Architectures/Standards and Initiatives
 - NIST Cloud Federation Reference Architecture & IEEE/P2302-2021: Standard for Intercloud Interoperability and Federation (SIIF)
 - GAIA-X
 - International Data Spaces (IDS) & IDS Reference Architecture Model (IDS-RAM)*
- Research and Innovation projects
 - Utilise and extend the offered services
 - Develop and provide toolsets
 - Feedback to DIASes?

AI4Copernicus in a nutshell



“Bridge Artificial Intelligence (AI) and Earth Observation (EO) worlds by making the AI4EU, the European AI-on-demand platform, the digital environment of choice for users of Copernicus data, for researchers and innovators.”



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101016798.



Main objectives

Drive technical integration

- Expand and deepen the integration of AI4EU with DIAS platforms to enrich the AI4EU service offering and enable far-reaching innovation
- Integrate resources and large EO data of existing providers, give access to training material and expertise and enrich the AI4EU resources catalogue.

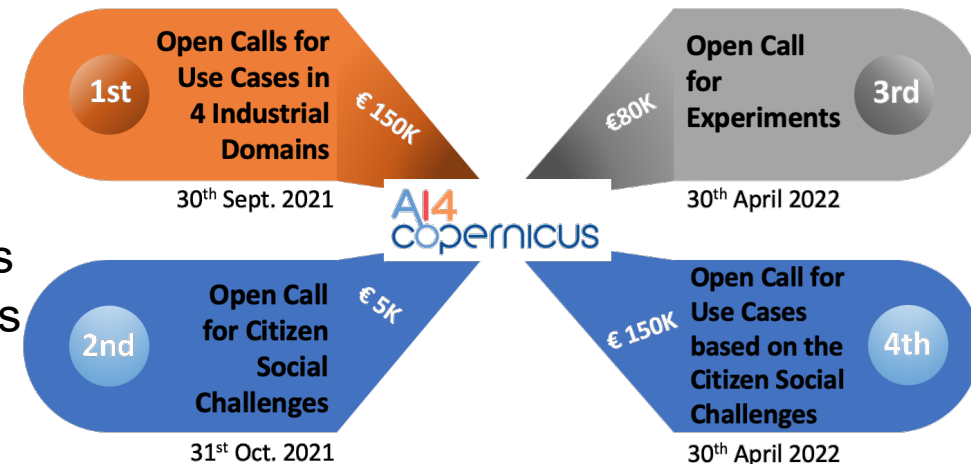
Create and AI-EO innovation cycle via Open Calls

- Incentivise diverse AI4EU and Copernicus communities to solve real problems of business and societal value, through 4 Open Calls leading to 17 AI&EO solutions and 2 citizen-driven social challenges

Drive the evolution, uptake and impact of all involved platforms

- Build on the integration work between AI4EU and WEkEO & CREODIAS and drive their evolution from data and information access services, to knowledge producing services as well.

Open Calls



AI4Copernicus funded projects



AI4
copernicus

1st Open Call **winners**
Consortia of SMEs | Use-cases



SR4C3
Super Resolution
for Climate Crisis Context



SECURITY



AI4
copernicus

1st Open Call **winners**
Consortia of SMEs | Use-cases



SCAVIHO
Scalable Vegetation Index
and Harvesting Forecaster

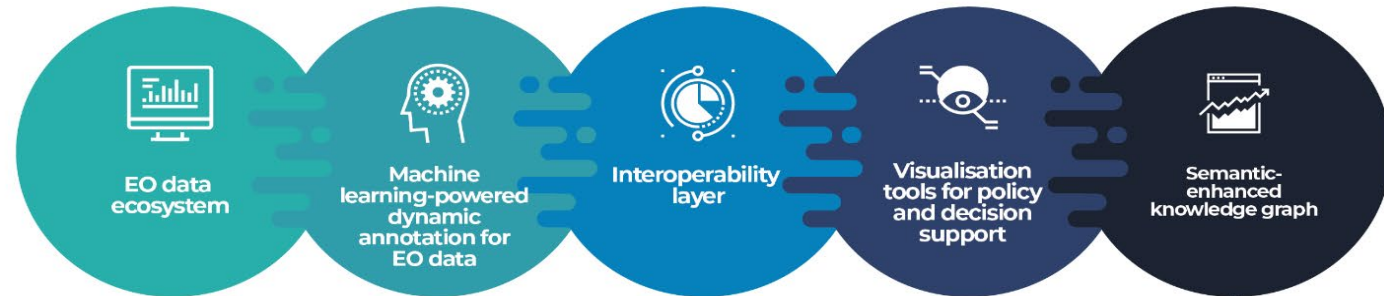


AGRICULTURE



<https://ai4copernicus-project.eu/winning-projects-ai4copernicus-open-calls/>

AI-augmented ecosystem for Earth Observation data accessibility with Extended reality User Interfaces for Service and data exploitation.- **EO4EU**



Services

- Machine learning for Semantic Annotation
- Semantic enhanced Knowledge Graphs
- Data Fusion
- Augmented and Virtual Reality
- Data Analytics Visualization

Data

Access at least **10** major EO data sources

Use Cases

7 Innovative Use Cases



Policy Priorities

- Support the EU Digital Single Market by lowering the barriers for EO services development
- Contribute to the Europe 2020:
- Blend a socio-economical, and data driven framework facilitating Sustainable Development

Target Groups

- EO Data Providers
- Private Sector
- Policy Makers and Actors
- Research and Academia
- Citizen Scientists / General Public
- Standards Development Organisations

Collaboration Landscape

- Collaboration Landscape
- R&I funded projects
- Large Enterprise & SMEs
- EO Data Providers
- EO Providers
- EOSC
- Destination Earth
- Multipliers (see section 2.2)
- Results-exploiting 3rd-party organisations
- Environmental Organisations

Community and Communication

- 1500** engaged community members from relevant Stakeholder groups with global coverage
- 2400** Social Media followers
- 7** original videos with over **3500** total views
- 2** podcasts
- 8+** journal papers and **12+** conference papers

Events

- 4** End-user use case workshops
- 2** EO4EU Impact events
- 2** EO Innovation Contests: one for industry and one for research/academia
- 14** dedicated webinars
- Presence at **20+** third party events

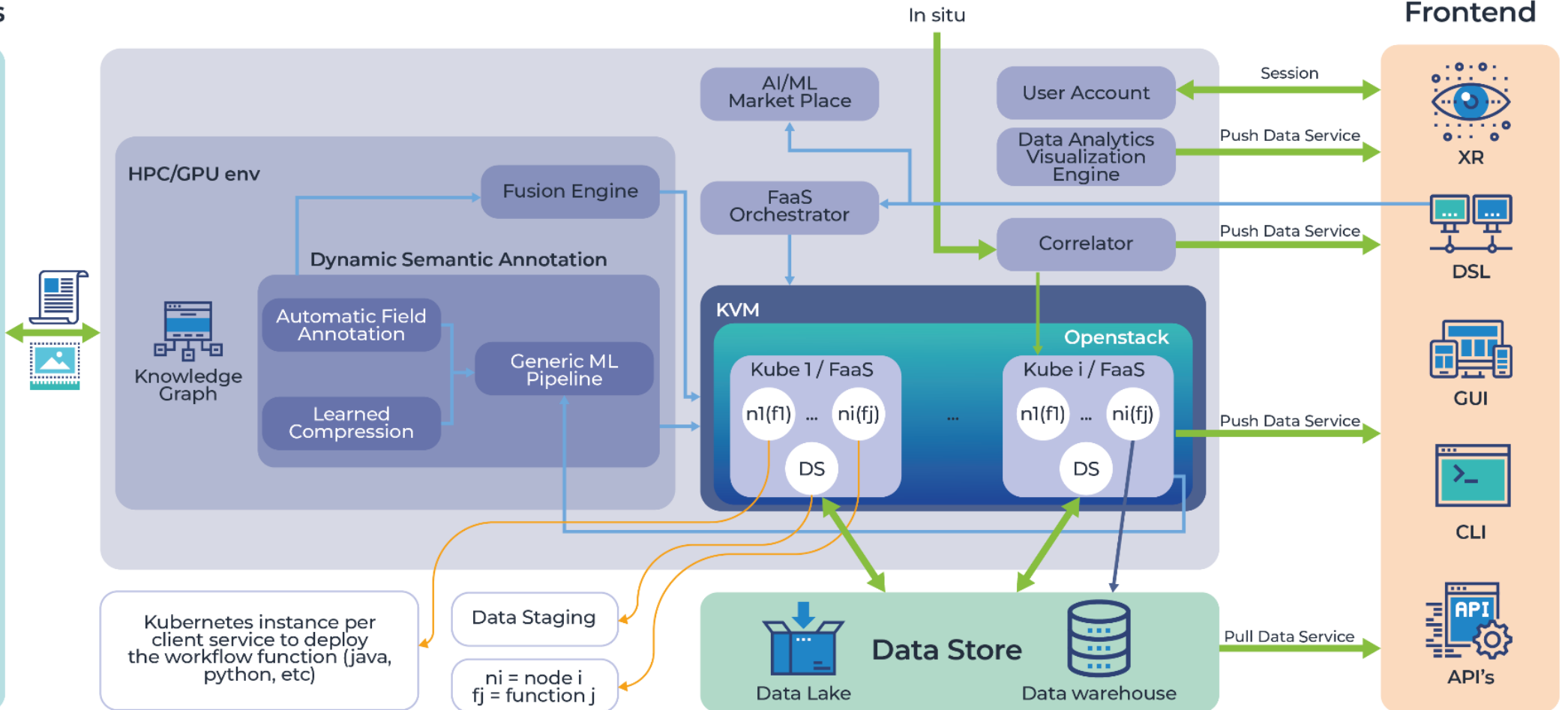
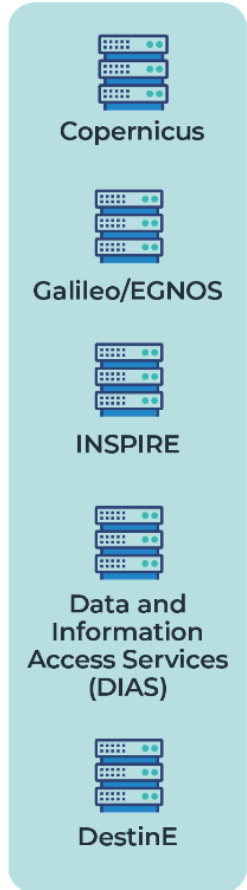
Insights

- External Advisory Group
- Grant committee to evaluate the EO Innovation Contests
- Policy Brief
- Exploitation & Sustainability Plan
- Revision or contribution of new standards



EO4EU Conceptual Architecture

Datasources



DestinE aim and goals

Destination Earth aims to develop a very high precision digital model of the Earth.

Key initiative, announced in:



A European Green Deal (2019)



A European strategy for data (2020)



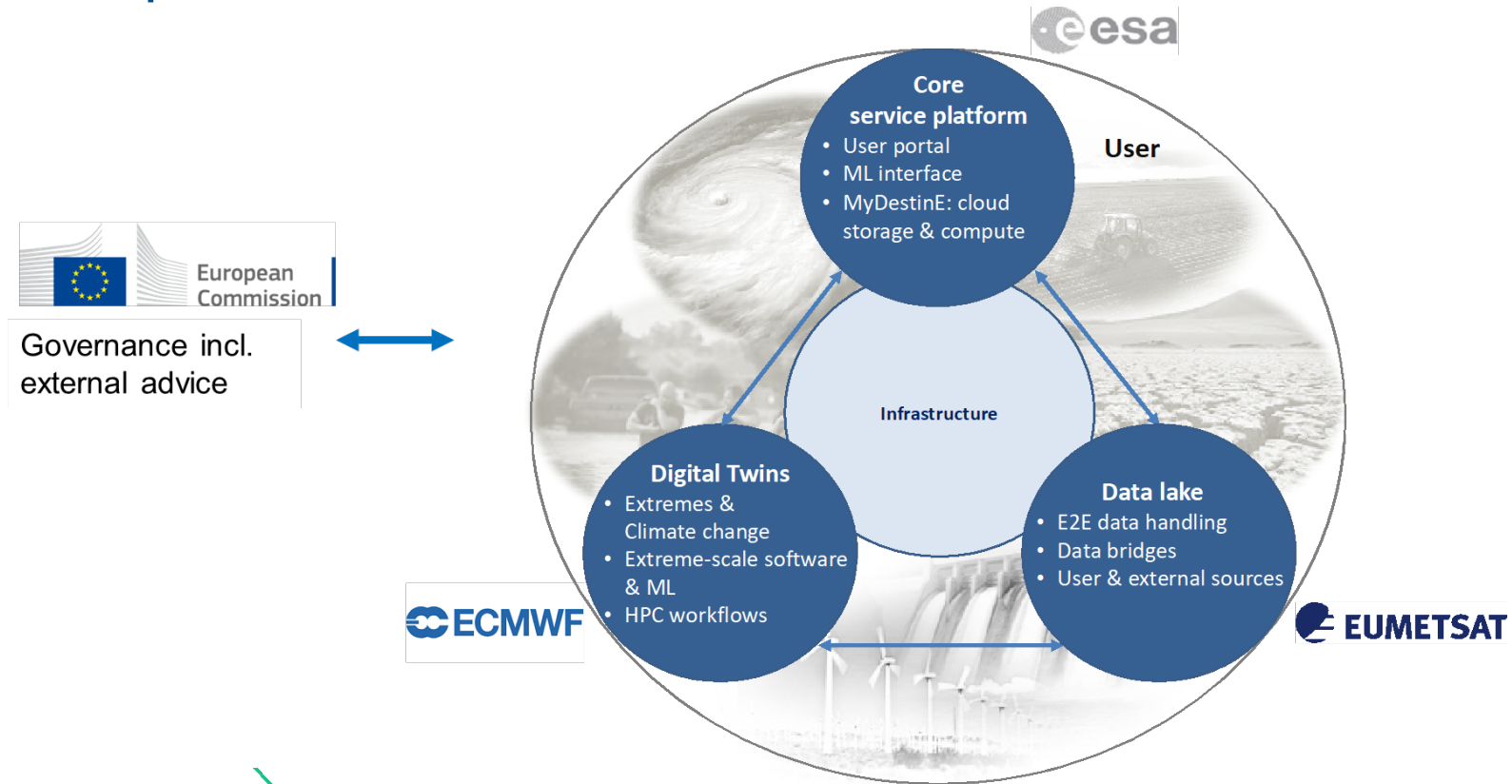
Shaping Europe's digital future (2020)



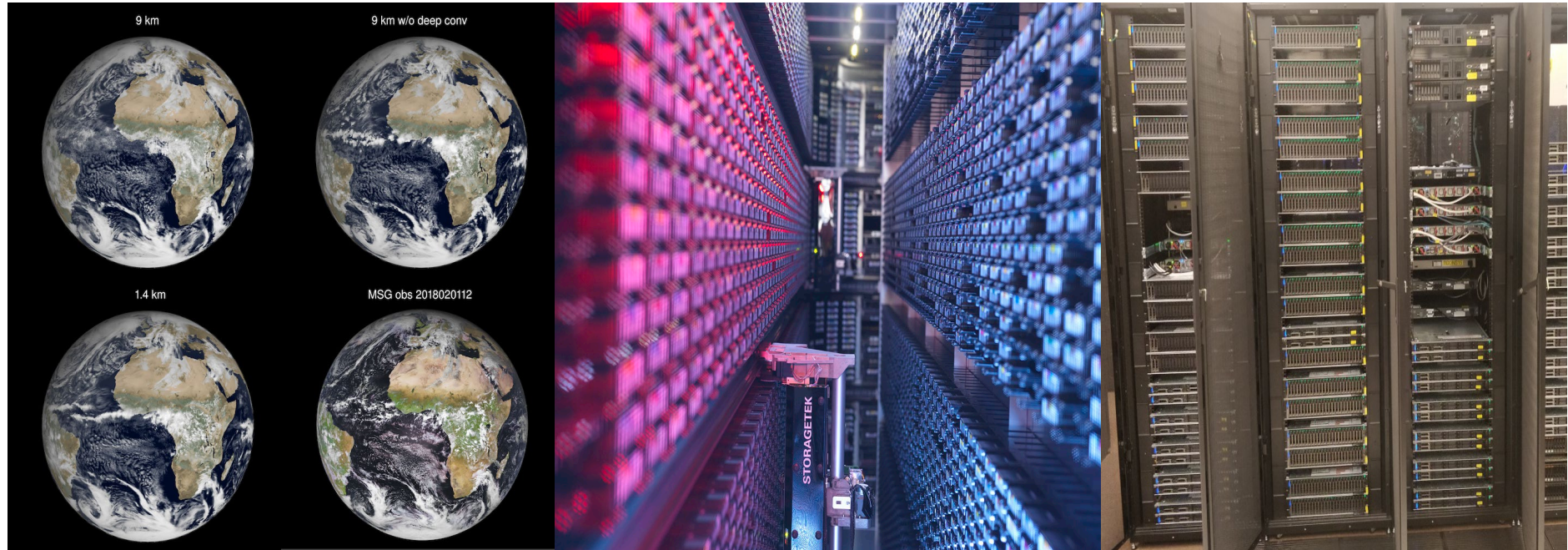
Develop a **very high precision digital model of the Earth (Digital Twin)** of the Earth to monitor and simulate natural and human activity and to develop and test scenarios for

- more sustainable development and achievement of the EU green deal objectives
- saving lives
- avoiding large economic downturns
- **support EU policy-making and implementation**
- reinforce Europe's industrial and technological capabilities in advanced computing, simulation, modelling, predictive data analytics and Artificial intelligence (AI)

DestinE implementation and timeline



European Weather Cloud Vision



*The European Weather Cloud aims to become the **cloud-based collaboration platform** for meteorological application development & operations in Europe and contributes to the digital transformation of the European Meteorological Infrastructure*

"a community cloud"



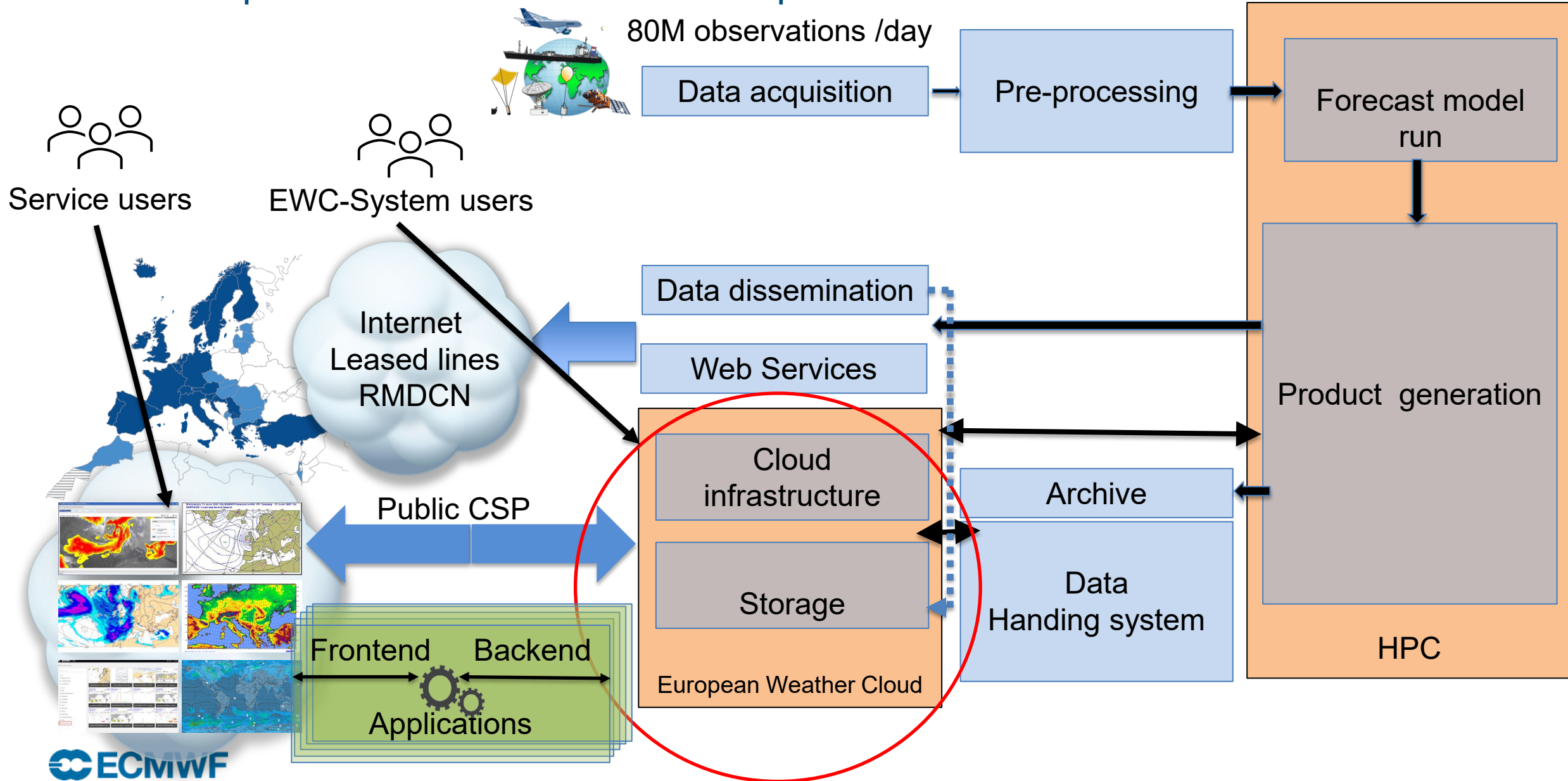
European Weather Cloud

www.europeanweather.cloud

- Started in January 2019(Operation phase Q3/2022)
- Collaboration between ECMWF and EUMETSAT
- Basic goals
 - Bringing the computation resources (Cloud) closer to our Big data (meteorological and satellite data)
 - Aiming at building a cloud federation with our MS
- User space
 - 35 Member/Cooperating States and their Meteorological and Hydrological services
 - Potential for cross discipline research and ML/AI using climate & weather data to other research domains i.e., finance, GIS, etc.
- Enabler for new research & development of new services
 - Close proximity to real big data storage and HPC resources
 - Tailored virtual resources for Big Data analytics and/or ML



ECMWF's production workflow and European Weather Cloud



Summary

- EO-based information services including NWP, Copernicus and DestinE in the future will provide enormous data volumes.
- Simplification and homogeneity/Standardization of data access and retrieval.
 - To a large extent, there is untapped potential for AI/ML (including data mining, data fusion) which needs to be unlocked through improved data access
 - Semantic annotation allowing advanced search and optimised data access and retrieval
 - Synergies with other initiatives like GAIA-X and IDS, EOSC and DestinE
- Cloud services (IaaS, PaaS & SaaS) should be more flexible/ keep up with the pace of the technology evolution.

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We look forward to seeing you on our booth in the centre of the exhibition area, attached to the central ESA booth...

#OneECMWF