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Topic	Tools to support the uptake and accessibility/exploitability of environmental observation information at European and global level
Type of Action	HORIZON-IA HORIZON Innovation Actions
Proposal full title	AI-augmented ecosystem for Earth Observation data accessibility with Extended reality User Interfaces for Service and data exploitation
Proposal Acronym	EO4EU



No.	Participant organisation name	Short Name	Country
1 (Co)	National and Kapodistrian University of Athens	NKUA	EL
2	European Centre For Medium-Range Weather Forecasts	ECMWF	UK
3	Novelcore	NVCR	EL
4	Cineca Consorzio Interuniversitario	CINECA	IT
5	Vilnius University	VU	LT
6	University of Latvia	UL	LV
7	Finnish Meteorological Institute	FMI	FI
8	Centro Euro-Mediterraneo Sui Cambiamenti Climatici	CMCC	IT
9	Sistema Gmbh	SIS	AT
10	Danaos Shipping Co. Ltd	DANAOS	CY
11	Center For Security Studies	KEMEA	EL
12	Ebos Technologies Limited	EBOS	CY
13	Trust-It Srl	Trust-IT	IT
14	Engineering Ingegneria Informatica S.P.A.	ENG	IT
15	Intelligence Forenvironmentand Security Srl Ies Solutions Srl	IES	IT
16	Meteorological and Environmental Earth Observation Srl	MEEO	IT
17	Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung E.V.	IVI	DE
18	Haute École Spécialisée De Suisse Occidentale	HES-SO	CH

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1. Excellence

1.1. Objectives & Ambition

1.1.1. Project Rationale and Background

The **rapid growth of Earth Observation (EO) data**, especially in the last decade, combined with the ever-increasing development of analytical theories and tools, has **generated a wide range of practical applications** covering land, maritime, climate change and atmospheric monitoring. The comprehensive and systematic structuring and processing of this data and **their transition to valuable knowledge** has helped us **model and predict natural processes**, as well as **understand the complex dynamics** of our planet's environment. In the meantime, analytical solutions based mainly on Earth imagery have also affected a wide range of traditional industries, from defence and government to insurance, commercial and health applications, while it has signified the **emergence of a dynamic sector of EO SMEs and startups** that brings to the foreground a large diversity of processes, services and geospatial products by utilizing satellite data. Only in 2018, according to the European Association of Remote Sensing Companies (EARSC)¹, this market generated over €1.25B of revenues, while it has been increasing by 10% every year since then.

Despite the significant volume and plethora of Earth Observation (EO) data offered from current EU services and repositories, **their access has not been yet extended beyond experts and scientists** to the wider industry to deliver tangible applications that improve our health and lives and protect the planet. Unfortunately, a small part of the market has that kind of expertise and as follows **high value EO information remains unexploited**, it is often fragmented, complex, diverse, difficult to find, retrieve, download and process, while users must have some kind of domain expertise to find, access, understand how to pre-process data, find storage solutions and transform data into useful formats for analytics and Geographic Information Systems (GIS). Moreover, in the event of severe natural disasters or extreme events, current engineering approaches have significantly failed to timely identify their occurrences, mainly because they utilize ad-hoc methodologies that do not integrate well to a holistic solution and do not provide accurate representations and predictions of upcoming severe environmental events. **Realistic simulations are considered computationally expensive**, as the specifications for appropriate infrastructure to process this data are considerably high, ranging from powerful systems, to cloud platforms with additional hardware like GPUs and High Performance Computing Facilities. Moreover, often theoretical models do not translate well into practical applications despite the rapid growth of EO data and the growth of analytical theories and tools.

The Commission has identified the potentialities and the challenges arising from the exploitation of EO data and has incorporated its exploitation as a pivotal aspect of its strategy towards a green and digital economy. The EU Data Strategy along with relevant EU policies and missions aims to bridge various stakeholders, including citizens and scientists with high value EO data and services towards increasing the environmental knowledge capacity. The Destination Earth (DestinE) Initiative directly contributes to the objectives of the European Green Deal. **DestinE's primary objective is to develop several very high precision thematic digital replicas of the Earth** to monitor and simulate natural and human activity, to develop and test scenarios that would enable more sustainable development and support European environmental policies. The large amounts of data produced by DestinE naturally contribute to the European Green Deal data space, facilitating data flows inside the EU and across sectors, for the common good. **Existing European programs like Copernicus, Galileo, EGNOS, INSPIRE already provide a significant amount of invaluable EO data** currently being used from many organizations and SMEs to deliver their value added services.

1.1.2. The EO4EU Vision and Technological innovation

The purpose of the EO4EU project is to provide innovative tools, services, methodologies and approaches utilising modern technologies that will assist a wide spectrum of users, from domain experts to simple citizens unaware of the plethora of data and capabilities offered by EU services, to access and process data and utilise the existing and future offered services. EO4EU will promote pre-operational European services like DestinE and will utilise existing platforms and services in a consolidated manner through the extensive use of disruptive technologies.

EO4EU aims to **support the wider exploitation of EO data** by delivering: **(i) Machine Learning (ML) methodologies for Semantic Annotation** of existing and growing data sources, **(ii) semantically enhanced knowledge graphs** that will enable structuring of content around diverse topic areas and building step by step journeys from different sources into a unified approach, **(iii) data fusion techniques** to extend the scalability of existing distributed systems, **(iv) Augmented and Virtual Reality** for interactive user experience, and **(v) advanced data analytics visualizations** for improved learning and evidence-based interpretations of environmental observations. EO4EU will demonstrate its operational and technical capacity on **seven (7) distinct pilots** that cover the thematic areas of **(i) personalized health care, (ii) sea route planning, (iii) ocean monitoring, (iv) food security, (v) food ecosystems, (vi) soil erosion, (vii) environmental pest, and (viii) crisis (responders)**

¹ https://earsc.org/wp-content/uploads/2020/07/Annual-report-2020_06-2.pdf
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management. These thematic areas will engage a **wide spectrum of involved stakeholders**, from EO providers, policy makers and actors, researchers and academics to citizen scientists and the general public to join efforts and provide their multidisciplinary expertise to support the Commission’s strategic goals towards the further exploitation of EO data. To further enhance the proposed approach, **the project will utilize existing background technologies and will capitalize on available data sources and data exploitation initiatives**, including Copernicus, GEOSS, INSPIRE, DestineE, Galileo, EGNOS, ECMWF, ESA/EPA, Datarade, CDP and Trucost Environmental.

By these means, we aim to support the EU Digital Single Market strategy’s “Access” pillar by lowering the barrier for the development and deployment of advance data-driven services in EO, contribute to the Europe 2020: creating smart growth through open source and interoperable services, and blend a socio-economical, and data driven framework facilitating Sustainable Development.

Our mission is to **contribute to the creation of an extensive collaboration hub** by creating synergies with R&I funded projects and the community of EO data that includes EO data providers, the EOSC ecosystem, the Destination Earth initiative, multipliers, third-party organizations and environmental bodies and initiatives. A set of outreach activities, from workshops, impact events, innovation contests, dedicated webinars and participation in third party events, will support the dissemination of our results to the wider public, while a communication plan will inform the scientific community about the effectiveness of the EO4EU approach. A dedicated External Advisory Board, a grant committee that will organize innovation contests and a solid exploitation and sustainability plan will preserve the quality of our approach and will safeguard the adoption of our solution even after the completion of the project.

The EO4EU concept and its main outcome are sketched in the figure below:

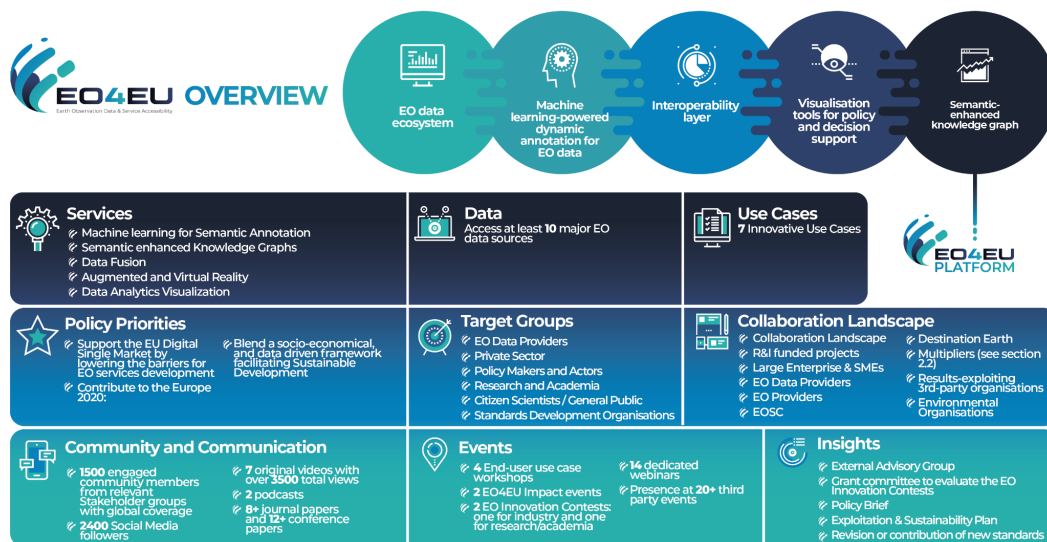


Figure 1: EO4EU in a nutshell

1.1.3. EO4EU Objectives

This section introduces the objectives of the EO4EU, outlines the baseline towards their achievement, correlates them with the project’s tasks and deliverables, while also presents dedicated KPIs to monitor their progress.

O1: To design and deploy an holistic Data Operation (DataOps) ecosystem to enhance access and usability of environmental observation information.

To establish an open access data ecosystem that bridges the gap of the individual data “silos” that communicate and directly interact with numerous sources of earth observation data. Such an ecosystem targets on increasing the usability and exploitability of earth observation information, acting as a liaison between various initiatives and Data Pools, such as DestinE, GEOSS, INSPIRE, Copernicus, Galileo, ECMWF. The proposed DataOps will act as a public-common EU data fetching mechanism for consolidating digital systems and services, focusing on facilitating stakeholders participation to global environmental observation data, actionable information and knowledge. Through the DataOps a variety of analytical tools and services will be also accessible including but not limited to visualization capacities and machine learning operational pipelines for large-scale analysis to improve the value of environmental observations (including in-situ data) and enrich the knowledge base needed to facilitate the reduction of anthropogenic impacts.

Means of achievement: To meet Obj 1, EO4EU incorporates in its 'backbone' a big set of systems and orchestration services as well as a multidisciplinary methodological approach that supports (i) the design of the overall technical framework (T2.3/ D2.3), taking into consideration the user requirements of the various end-users (T2.2/D2.2), the development and deployment of the components (T3.1-T3.4/D3.1-D3.4), and the