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Project: 101188248 – HORIZON-INFRA-2024-EOSC-01

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Start date
1 January 2025

Duration
48 months

Budget
7,9 million euros

European partners
18

Countries involved
8

Project type
Horizon Europe

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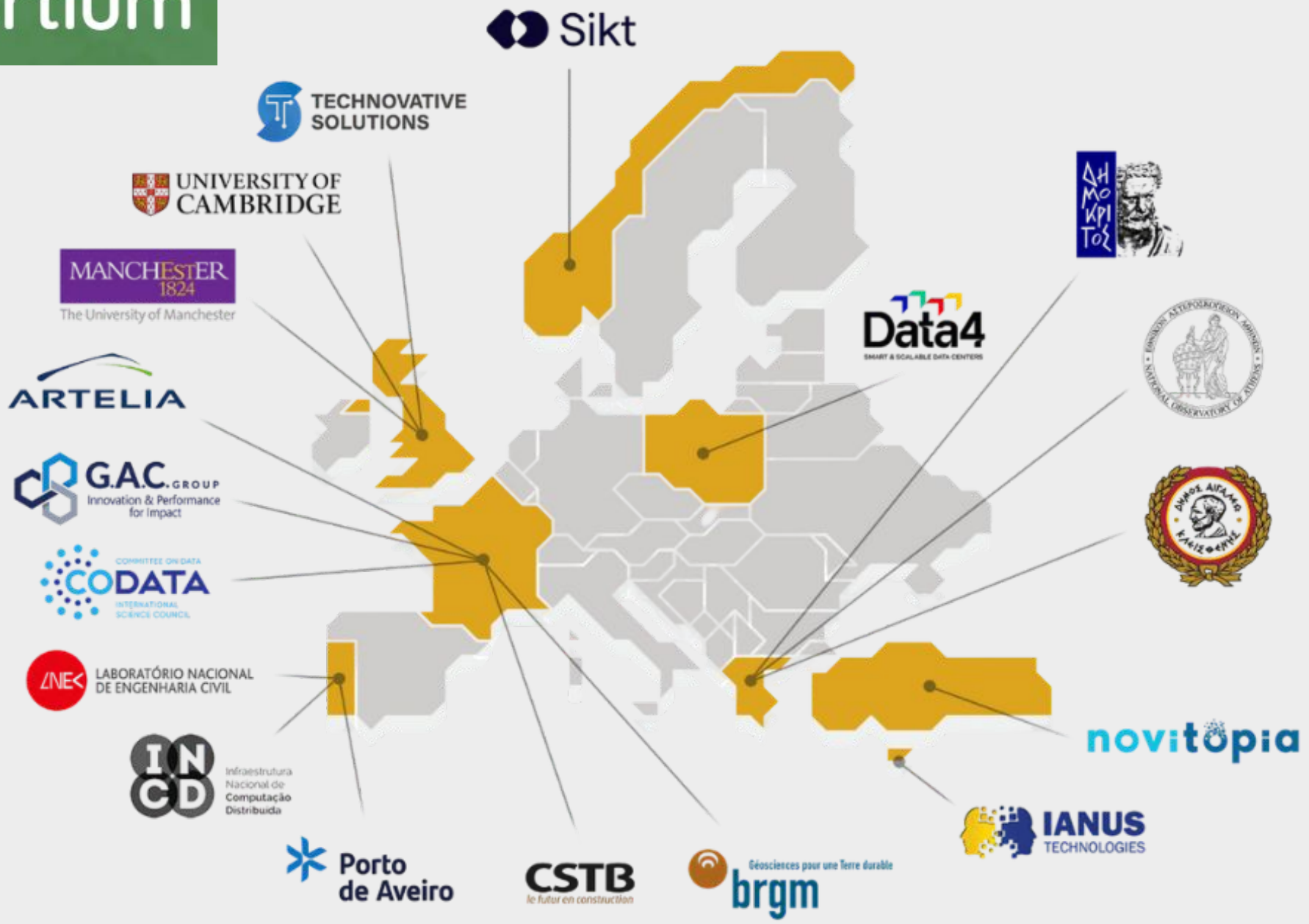
Consortium



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About Climate-Adapt4EOSC

Advancing climate adaptation through open science and data integration in the European Open Science Cloud (EOSC)

The ambition of the European Open Science Cloud (EOSC) is to provide European researchers, innovators, companies and citizens with a federated and open multi-disciplinary environment where they can publish, find and reuse data, tools and services for research, innovation and educational purposes.

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The Climate-Adapt4EOSC project specifically empowers researchers across multiple disciplines to tackle climate change more effectively by providing an advanced, EOSC-centred collaborative research environment. This environment integrates existing EOSC data and services while introducing new datasets and innovative features, such as FAIRification and Mapping and Entity Matching capabilities. The project will create a climate change adaptation ontology and an EOSC Climate-Adapt Knowledge Graph, enabling enhanced findability, accessibility, tracking, and life cycle management of diverse research outputs. By fostering interoperability and innovation, Climate-Adapt4EOSC will significantly strengthen the capacity of European scientific communities to address climate change.

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Challenges

The Climate-Adapt4EOSC project addresses several critical challenges that hinder the effectiveness of climate change adaptation research and action. These include the fragmentation of data across heterogeneous platforms and data spaces, the lack of interoperability between datasets and services, and insufficient infrastructural support for the generation and sharing of FAIR (Findable, Accessible, Interoperable, Reusable) data. Legal and organisational barriers also obstruct access to and reuse of sensitive climate-related data, particularly in cross-border and multidisciplinary contexts. Additionally, inconsistencies in metadata standards and file formats, combined with limited awareness of FAIR principles among data providers, further complicate the integration and usability of climate data. Without addressing these barriers, meaningful collaboration across scientific disciplines and policy domains remains difficult to achieve.

Project Challenges

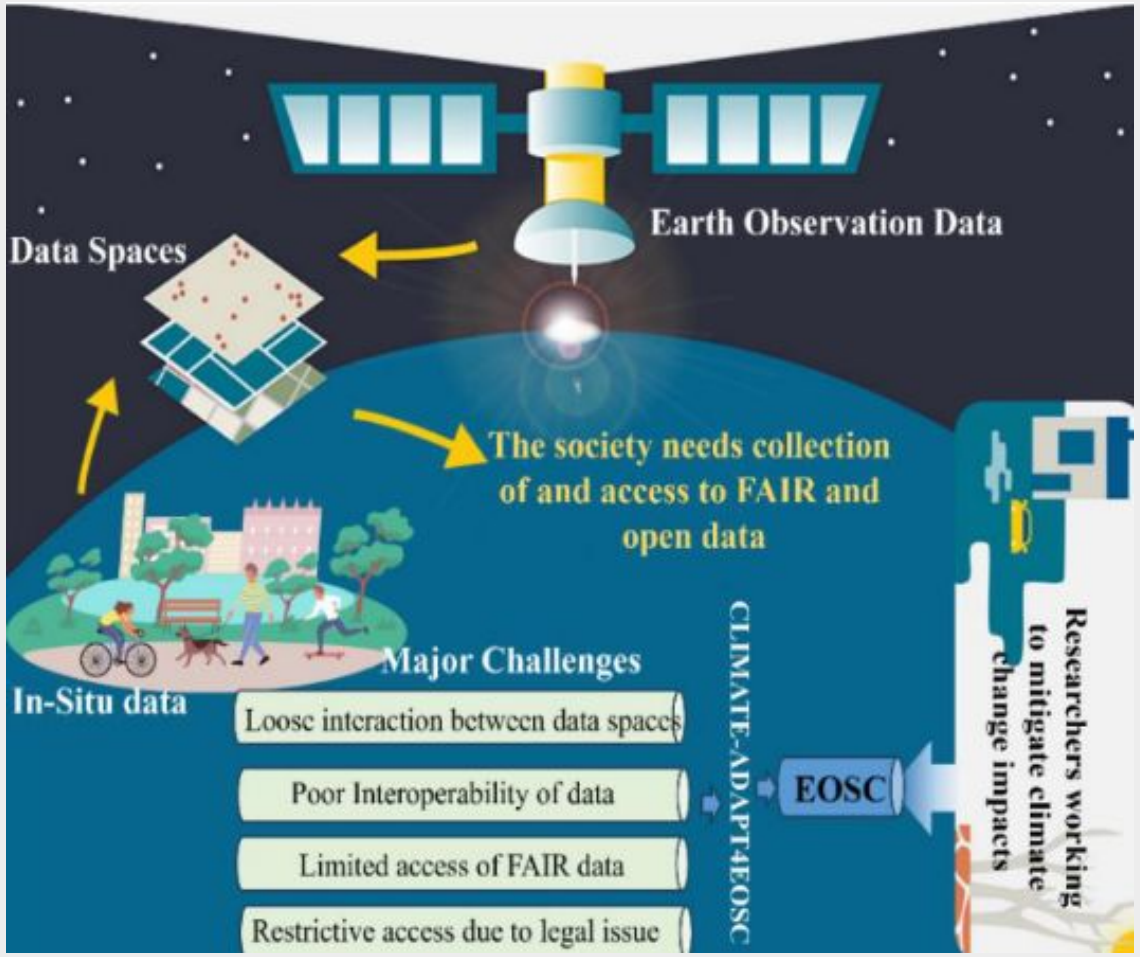
Integration of data spaces

social aspects + Cross-domain research

access to high-quality FAIR compliant datasets
+
Open Science practices

intelligent and proportionate access to sensitive data

Need of interoperability frameworks to allow data combination



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Objectives

Climate-Adapt4EOSC aims to create a seamless, FAIR-compliant research environment for climate adaptation data and services within EOSC. It seeks to improve data accessibility, interoperability and trust through five dedicated frameworks. The project supports stakeholders in integrating, managing and reusing data to inform policies and research. Demonstrations in five EU countries will validate the approach and promote broader adoption.

Project Objectives

- **User & Stakeholder Needs (PO1)** – Identify user requirements, challenges, and existing tools to guide the development of innovative climate data solutions.
- **FAIR Data Infrastructure (PO2)** – Develop **CLIMATE-ADAPTdata4EOSC**, ensuring seamless data connectivity and interoperability within EOSC.
- **Interoperability Frameworks (PO3)** – Establish organizational and legal frameworks to enhance open data sharing and services for climate adaptation.
- **Service Development (PO4)** – Create **CLIMATE-ADAPTservice4EOSC**, a suite of tools for data representation, management, and analysis across disciplines.
- **Demonstration & Adoption (PO5)** – Validate FAIR data sharing through three use cases (UCs) and eight replication cases (R-UCs), promoting user engagement.
- **Sustainability & Collaboration (PO6)** – Align with EOSC and climate adaptation initiatives to ensure long-term impact and integration of project outcomes.

Methodology

Data

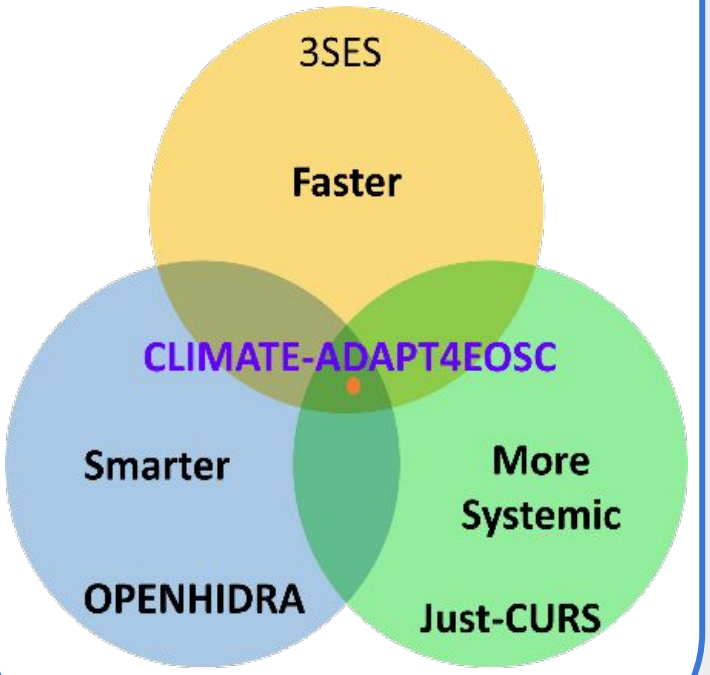
Ontology Development for FAIR Data

Knowledge Graph for FAIRification & Data Trackability

Interoperability frameworks

- Technical
- Semantic
- Cross-domain
- Organizational
- Legal

Services



Methodology : FAIRification of Data

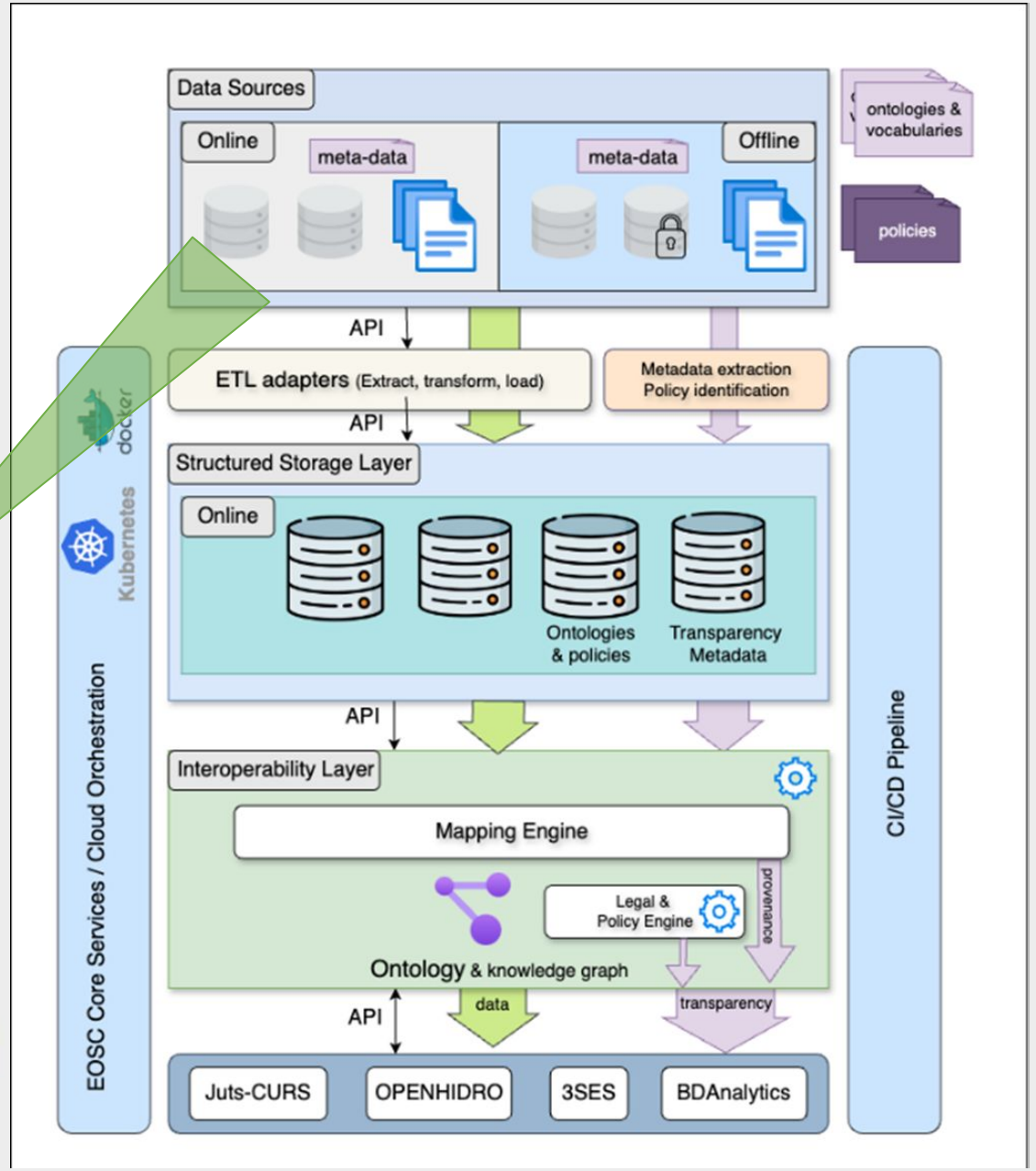
The methodology focuses on :

- FAIR Digital Climate Objects
- interoperability frameworks
- ontology-based semantic mapping
- and privacy preservation to data access and integration within EOSC.

Data

Ontology Development for FAIR Data

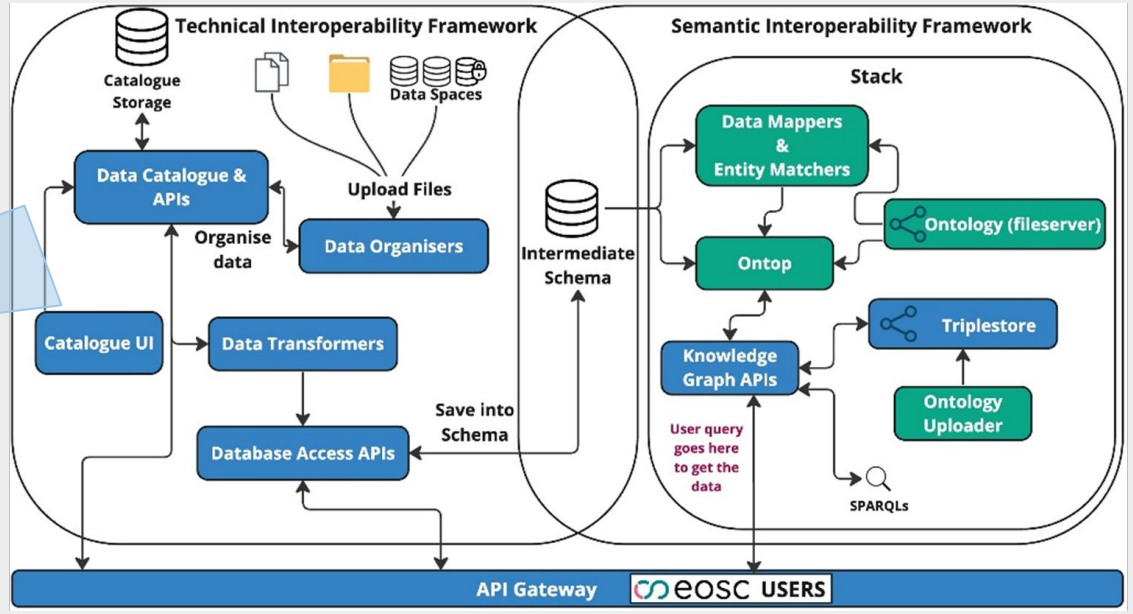
Knowledge Graph for FAIRification & Data Trackability

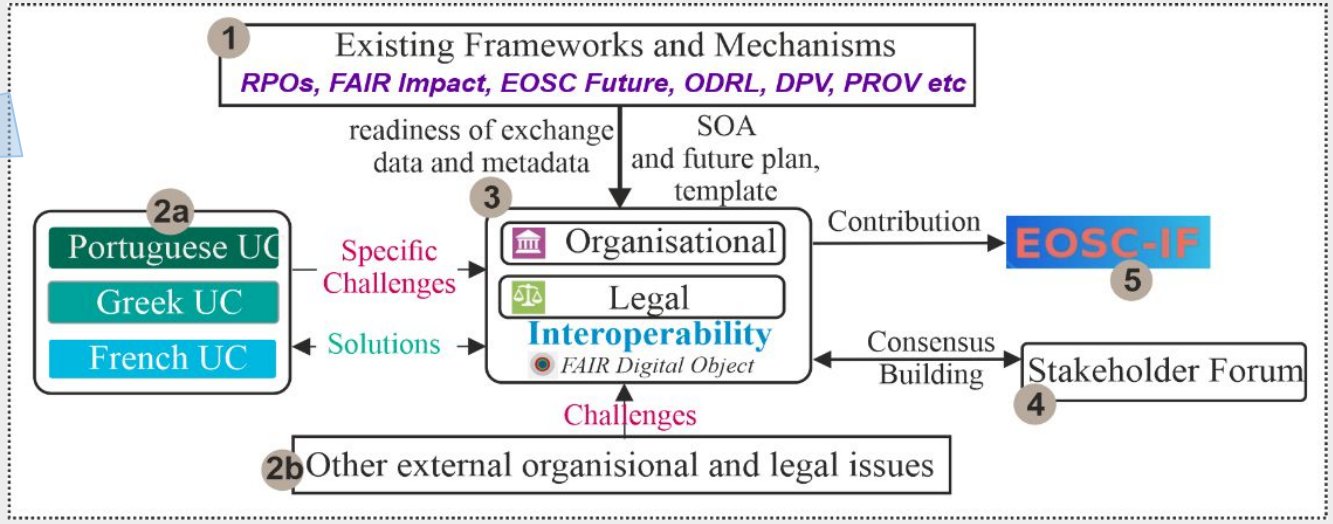


Methodology : interoperability frameworks

Interoperability frameworks

- Technical
- Semantic
- Cross-domain
- Organizational
- Legal





3 use cases

Use case #1

Greece – Aigaleo

- Aveiro Port (Portugal)
- West Athens (Greece)
- Strovolos Municipality (Cyprus)

More info

Use case #2

Portugal – Centro region

- Port of Piraeus (Greece)
- Rhodes Port (Greece)
- Port of Dunkirk (France)

More info

Use case #3

France – Metropolitan territory

- Rhodes island (Greece)
- Data4 (Poland)

More info

Use case #1

Greece – Aigaleo (Just-CURS)

Location

Urban municipality in the Athens metropolitan area, Attica region.

Key facts

Densely populated district with high exposure to urban heat and socio-economic vulnerabilities.

Actions

Implementation of Just-CURS digital twin model to assess localised urban climate risks and enable citizen-informed planning.

Impacts

Increased awareness of climate impacts and stronger citizen engagement in adaptation policies.

Expected impacts

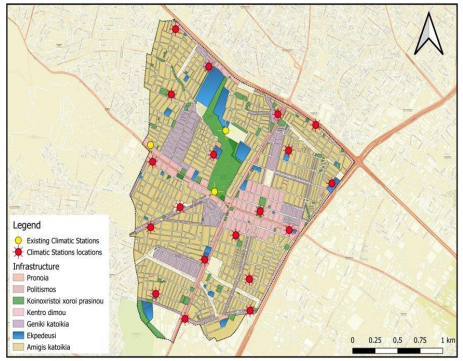
More inclusive and tailored urban resilience strategies targeting vulnerable communities.

Leading partners:

Replicators:

- Aveiro Port (Portugal) →
- West Athens (Greece) →
- The Municipality of Strovolos (Cyprus) →

UC1 AGL: Digital Twins for Just Climate Urban Resilience Service (Just-CURS) in Socially Vulnerable Communities



AGL Case Study

- Egaleo faces extreme heat (up to 45°C), fire, and flood risks.
- The city is updating its SECAP plan for the next decade.

Smart climate stations, Rock the Block, Environmental & climatic stations network

Replicators

GK-1 (demo r2): Aveiro Port, Portugal

- Climate risk assessment
- Resilience assessment for port personnel and commuters.
- Digital twin to optimize climate adaptation NBS

GK-2 (demo r3): West Athens, Greece

- Climate risk assessment
- Digital Twin
- Assessment of the benefits from implementing large scale ecological corridors

GK-3 (demo r3): Strovolos, Cyprus

- Climate risk assessment
- Community Resilience assessment for the local vulnerable groups
- Digital twin for identifying CCA interventions

Use case #2

Portugal -Centro Region (OPENHIDRA)

Location

Coastal wetland in central Portugal, influenced by Atlantic tides.

Key facts

Ecologically sensitive area with increasing exposure to sea-level rise and saline intrusion.

Actions

Demonstration of OPENHIDRA service to enhance flood forecasting and coastal monitoring.

Impacts

Improved early warning and ecosystem protection.

Expected impacts

Better anticipation of climate impacts and strengthened ecosystem-based adaptation.

Leading partners:

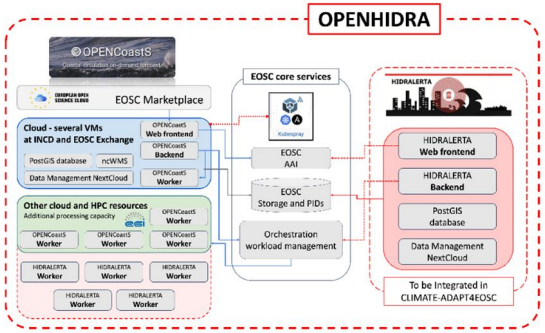
LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL

Replicators:

- Port of Piraeus (Greece) →
- Rhodes Port (Greece) →
- Port of Dunkirk (France) →

UC2 Centro Region: OPENHIDRA - A service to empower the users and stakeholders to adapt to climate change in the coastal region

Centro Region Case Study



The main objective integrating OPENCoastS and Hidralerta within Aveiro Lagoon is to boost the region's resilience to coastal and estuarine hazards.
Combining high-accuracy simulations with management tools, the service will support both long-term climate adaptation and daily operational strategies, aiming to protect critical infrastructure, economic activities, and environmental assets from coastal threats.

Replicators

PT-1 (demo r2): Port of Piraeus, Greece

- Piraeus Port is a key commercial maritime hub.
- Address Mediterranean meteo-oceanographic conditions.
- The demonstration will assess wave disturbance inside the port.
- Support climate adaptation and safeguard maritime operations.

PT-2 (demo r2): Rhodes Port, Greece

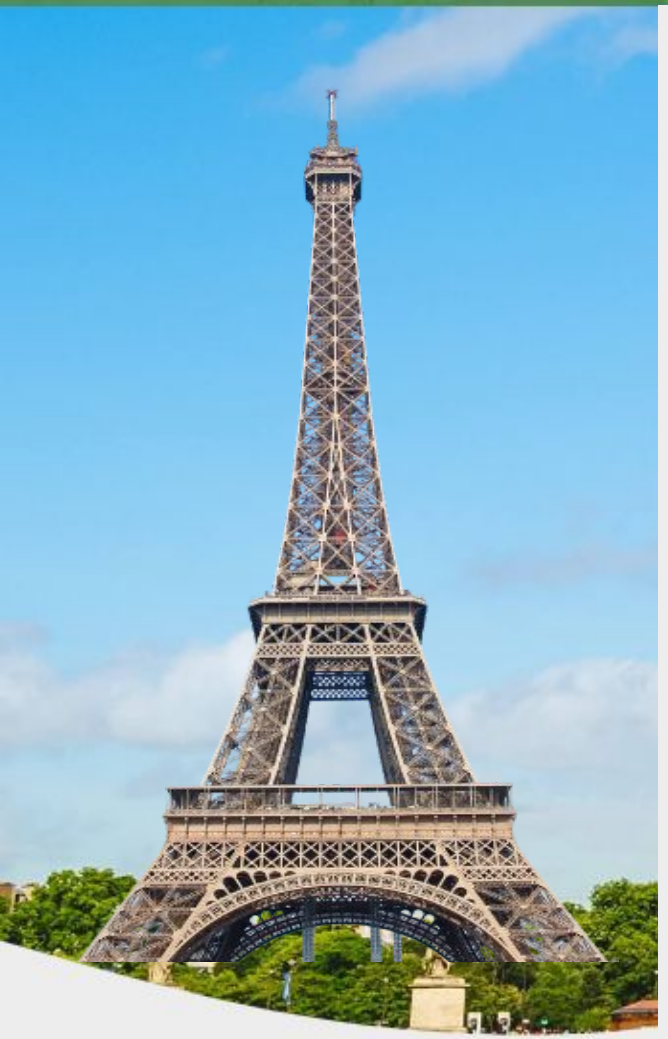
- Crucial for island supplies and Mediterranean trade.
- Service will provide wind and wave data for climate adaptation planning.
- Aims to minimize disruptions to port operations and supply chains.
- This highlights the need for adaptation strategies to protect critical infrastructure in isolated areas.

PT-3 (demo r3): Port of Dunkirk, France

- 7th largest port in the North Sea
- Replicating provide insights into North Sea meteo-oceanographic conditions.
- The goal is to ensure continuity in maritime operations and supply chains

Use case #3

Metropolitan France (3SES)



Location

Three selected regions in mainland France with varied exposure to clay shrinkage and swelling risks.

Key facts

France is significantly exposed to **shrink-swell risks linked to clay soils**, particularly under intensifying drought conditions. The hazard has major implications for buildings, infrastructures and urban planning, yet remains insufficiently documented.

Actions

The **Space2Earth Service (3SES)** is applied to deliver **static and dynamic mapping of shrink-swell risks**, using satellite data and physical datasets (e.g. BRGM, CSTB). The study integrates predisposing (soil composition, site characteristics) and triggering factors (climate, water content) to establish mathematical models of risk. This use case explores **three distinct regional contexts**: one with a high number of claims, one with very few claims, and one with a heterogeneous risk profile.

Impacts

Enhanced knowledge of site-specific geotechnical risks, including the influence of construction practices, environmental context, and land use. Improved capacity to anticipate and mitigate impacts on buildings, infrastructures, and vegetation.

Expected impacts

- Updated and more accurate national exposure maps.
- Foundations for an **alert system** based on soil moisture variations.
- Development of **normative recommendations** for climate-resilient construction.
- Contributions to territorial planning, insurance modelling, and long-term climate adaptation strategies.

Leading partners:

brgm — Géosciences pour une Terre durable

CSTB — le futur en construction

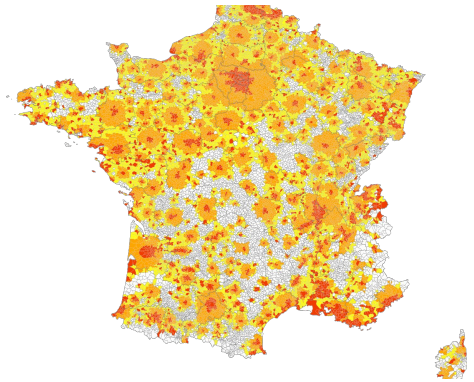
ARTELIA

Replicators:

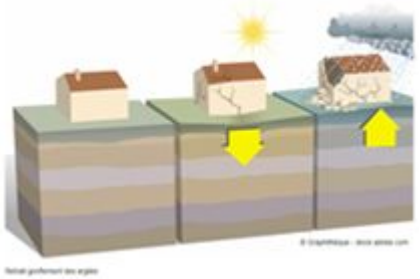
Rhodes Island (Greece) →

DATA4 (Poland) →

UC3 Metropolitan France: 3SES - Shrink-Swell from Space2Earth Service for static and dynamic mapping of shrink-swell risks for old and new infrastructures



Metropolitan France Case Study



- **Enriched Risk Assessment**
- Uses satellite and complementary datasets (BDNB, BRGM).
- Develops static risk models (identifying predisposing factors).
- Creates dynamic alert systems (analyzing triggering factors).

- Tested in 3 French regions with different claim patterns.
- Aims to improve risk prediction and support infrastructure insurance decisions.

Replicators

FR-1 (demo r2): Rhodes Port & Rhodes Town, Greece

- The replication in Rhodes will study clay shrinkage and swelling risks.
- It represents similar challenges across southern Europe.
- The focus is on impacts on networks, buildings, and vegetation.
- Findings will guide measures to protect the island's vital operations.

FR-2 (demo r3): DATA4 (Datacenters), Poland

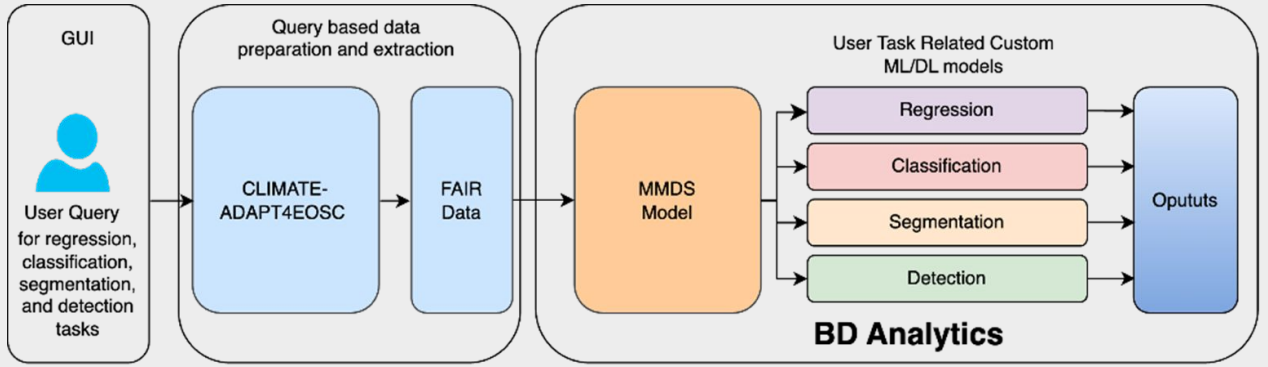
- The replication will assess clay swelling and shrinkage risks at industrial sites in Poland.
- Focused on one or two sites of this manufacturer.
- Technical view of the impacts on industrial operations.

4 Services

To demonstrate the effectiveness of our Climate-Adapt4EOSC value of sharing and reusing of research data, our CLIMATE-ADAPTservice4EOSC will comprise four novel services:

BDAnalytics

BDAnalytics is an AI-powered analytical service designed to process large volumes of climate-related data efficiently. It leverages a novel self-supervised machine learning model requiring minimal labelled datasets. The service supports multiple tasks—including classification, detection, segmentation and forecasting—tailored to user-defined use cases such as urban heat risk, soil vulnerability, or coastal changes. It offers up to 90% reduction in computational resources compared to state-of-the-art approaches, while increasing accuracy and usability of the outputs for researchers and policymakers.

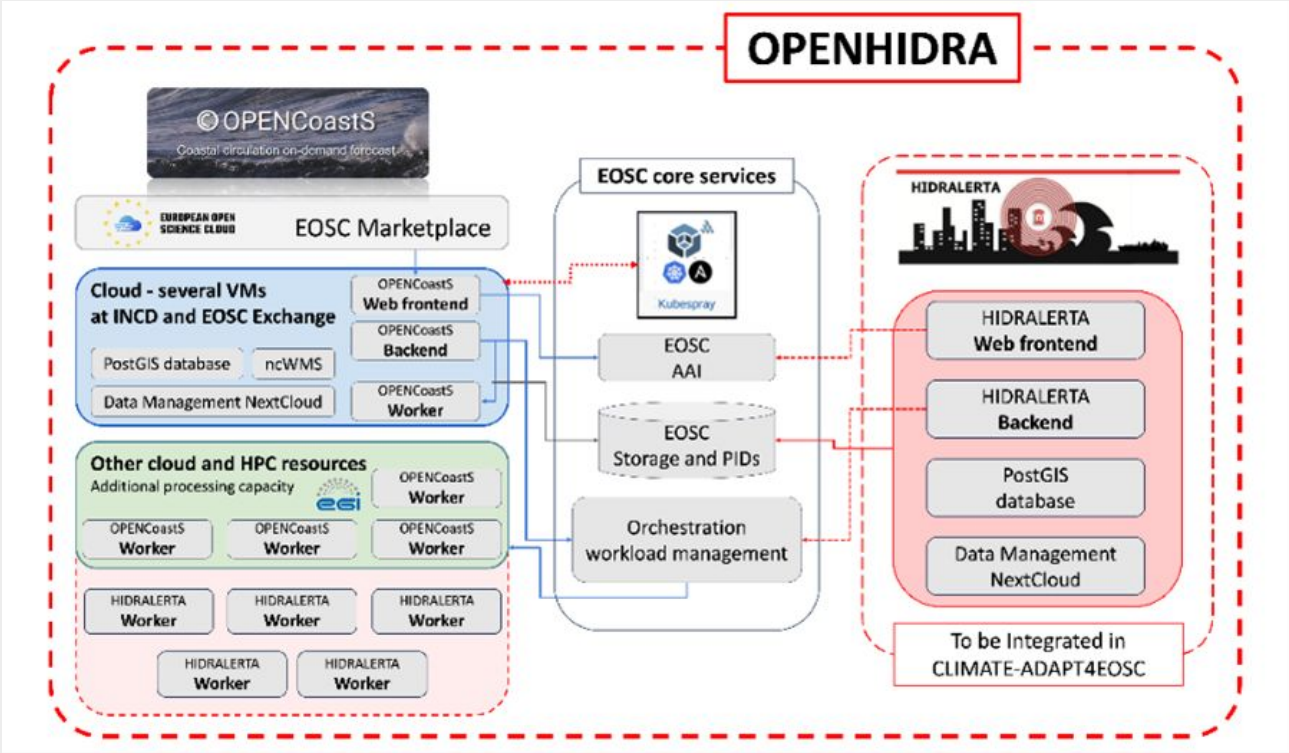


4 Services

To demonstrate the effectiveness of our Climate-Adapt4EOSC value of sharing and reusing of research data, our CLIMATE-ADAPTservice4EOSC will comprise four novel services:

OPENHIDRA

OPENHIDRA integrates two existing solutions (OPENCoastS and Hidralerta) to deliver a free, EOSC-based service for climate adaptation in coastal and port areas. It provides real-time alerts and on-demand forecasts to support port authorities and coastal managers in anticipating flood risks, sea-level rise, and operational disruptions. The service enables smarter, localised climate adaptation strategies by linking environmental monitoring data with predictive modelling tools.



OPENHIDRA

National Centers for Environmental Information
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

METEO FRANCE

METEOGALICIA

Atmospheric Data:
atmospheric parameters (winds, pressure, precipitation) (NetCDF)

EMODnet
European Marine Observation and Data Network

Oceanographic Data:
water levels and waves (csv and NetCDF)

Copernicus Marine Service

Oceanographic Data:
water levels, salinity, temperature and waves (csv and NetCDF)

copernicus sentinel

Oceanographic **Data:**
Satellite images (GeoTiff)

Output data for other added-value services: time series (csv) and spatial data (NetCDF)

Output Data:
water levels, velocity, topobathymetry (csv, NetCDF and GeoTIFF)

ECMWF

Oceanographic and Atmospheric Data:
waves, winds, pressure (grib)

Wave buoys

Oceanographic Data:
waves (txt/csv)

Wave overtopping Data
(wmv, mpeg4, etc)

Gyroscopes

6 DoF ship motions
(csv)

Output data for other added-value services: time series (csv, txt), risk levels (txt) and spatial data (grd)

4 Services

To demonstrate the effectiveness of our Climate-Adapt4EOSC value of sharing and reusing of research data, our CLIMATE-ADAPTservice4EOSC will comprise four novel services:

Just-CURS

Just-CURS is a digital twin service that enhances urban climate resilience with a strong citizen science component. It combines high-resolution environmental models, socio-economic data, and citizen feedback to simulate local climate impacts. The service supports "what-if" scenario analysis (e.g. impact of nature-based solutions), urban heat island mapping, and infrastructure stress assessments. It is designed for municipalities and local actors to co-design equitable and informed adaptation pathways, particularly in socially vulnerable areas.

4 Services

To demonstrate the effectiveness of our Climate-Adapt4EOSC value of sharing and reusing of research data, our CLIMATE-ADAPTservice4EOSC will comprise four novel services:

3SES – Shrink-Swell from Space2Earth Service

3SES is a mapping and risk assessment tool addressing clay soil shrink-swell phenomena, which increasingly threaten buildings and infrastructure due to climate variability. The service allows users—citizens, professionals, institutions—to assess their exposure through static and dynamic risk maps. A free version is available to the general public, while a more detailed, chargeable version targets professionals. 3SES promotes early risk mitigation and cost-effective renovation or construction strategies, especially in vulnerable urban and peri-urban areas.

Stakeholder Forum

Purpose

The purpose of the Climate-Adapt4EOSC **Stakeholder Forum** is to increase the project's positive impact by contributing and promoting its activities focused on climate change adaptation.

The forum offers a privileged source of information and engagement with the project, its activities and outputs. It also allows an opportunity for a wide range of stakeholders to provide constructive feedback and advice.

Membership

The forum is open to individuals with an interest in the project's outcomes, or who represent communities that could benefit, reuse or further develop project's them.

The forum is not a decision-making body, but may issue statements of advice for the project, with approval based on a consensus process.

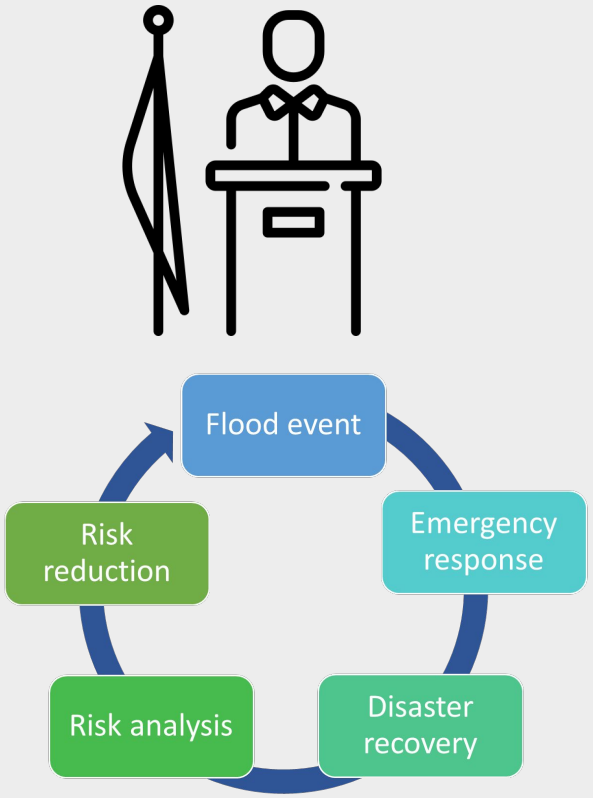
Membership of the **Stakeholder Forum** remains active as long as the forum is active (at least until 31st December 2028) or the member announces the wish to withdraw from the forum. A member withdrawing from the forum will remain bound by the applicable clauses in these Terms of Reference.

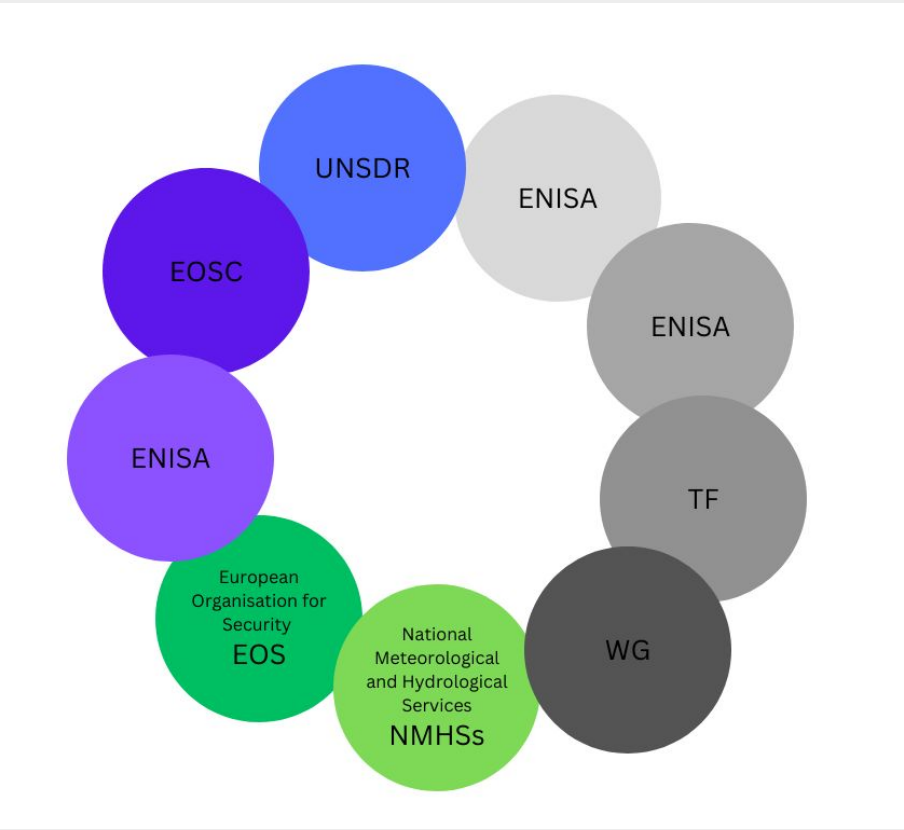
Target Groups

National, EU, & International knowledge communities

Government & policy makers

Influential EU bodies/ associations





Outcomes

EOSC Community

The CLIMATE-ADAPT4EOSC comprises new tools and methods for data and metadata generation after building census with the EOSC community through stakeholder forum will be useful for the researchers to develop further in other area of expertise.

R&I Community

Adopt the CLIMATE-ADAPT**service** & CLIMATE-ADAPT**data** to store, share, access, analyse and process data to mitigate climate engage impacts.

Decision Makers

Successful demonstration of the services EU countries, through 3 round of demonstration will facilitate to promote the EOSC among the decision makers.

Services + novel tools on interoperability & Knowledge Graph will change the networking and data sharing in the sector of climate change and disaster risk resilience.

Policy Makers

Successful implementation of 4 services toolkit exploiting local big data of collective intelligence to identify and act on policy, legal and operational issues at national and EU levels.

Impacts

Scientific

- Better nowcasting, hindcasting, and forecasting of extreme weather.
- With BDA analytics and social-technical innovations, Helps communities understand risks, exposure, and vulnerabilities.
- Supports data sharing, storage, and access for research

Economic

- Improves at least 3 services with big data analytics and citizen science data.
- Enhances climate change adaptation.
- Protects vulnerable lives, communities, and critical infrastructure.

Social

- Our Services will improve climate adaptation.
- Helps prepare for current and future climate impacts.
- Enables national, regional, and local risk assessment.
- Supports scalable, region-specific adaptation strategies.

Dissemination, exploitation and communication

Exploitation

Action roadmap
Monitoring tool
Stakeholder forum

→ Include CLIMATE-ADAPTAEOSC results as best practice cases in national and EU institutes and initiatives

Risk Data Hub | C3S | GEOSS

Dissemination

Research Participation
Networking
Workshops

→ Conferences | Journals

RDA | Climate-KIC, Knowledge Network | IFAFRI | Synergies with similar Projects

Data | Models | Tools

Communication

At least one public event to showcase CLIMATE-ADAPT4EOSC achievements and transferable results.

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Project Coordination

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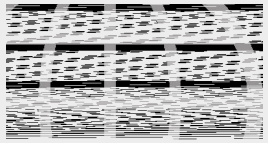

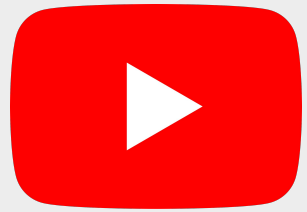

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