# FAIR-EASE USE CASES

OSFAIR

25-27 September 2023

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Funded by
the European Union

# FAIR-EASE: FAIR-EArth Sciences & Environment services

INFRAEOSC: “Innovative and customizable services for EOSC”
HORIZON-INFRA-2021-EOSC-01-04

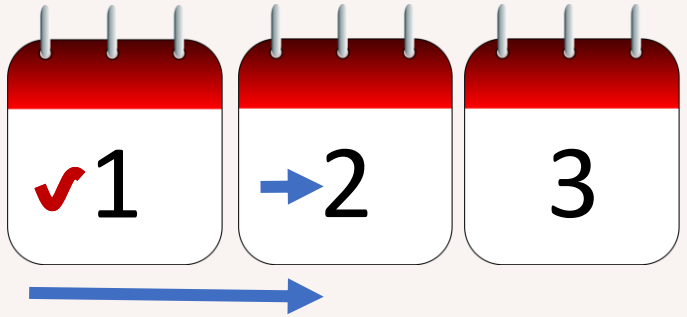
Funded by the European Union

A consortium composed of
26 partners
8 EU member states
+ 1 associated country

Coordinator: CNRS (Fr)

Duration: 3 years

Start date: 1 September 2022
End date: 31 August 2025



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to understand, monitor and exploit
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are still **domain dependent** and
limited by **fragmentation** linked to **sectorial** expertise
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to understand, monitor and exploit
while saving the planet and its resources
are still **domain dependent** and
limited by **fragmentation** linked to **sectorial** expertise
favouring **redundancy.**

This also limits the opportunity of **knowledge sharing**, **integrated studies**,
**holistic approaches for** challenging **research with large societal impacts,**
such as climate change, biodiversity conservation, agriculture sustainability, food security, life safety and wellbeing.

# The rationale of FAIR-EASE

To go beyond this state-of-the-art, FAIR-EASE mission is to customize and operate distributed and integrated services for observation and modelling of the **Earth system**, **Environment** and **Biodiversity** by direct involvement of **Domain** and **Technical experts**.

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**Key strategy:** implement **FAIR principles**
in close **cooperation with user-communities**,
in the framework of **the European Open Science Cloud (EOSC)**
and with the involvement of **research infrastructures**
(EMBRC, Dataterra, LandSupport ….)


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and with the involvement of **research infrastructures**
(EMBRC, Dataterra, LandSupport ….).

The aim is to improve, validate and share the useful components (data and software)
their **F**indability, **A**ccessibility, favouring the **I**nteroperability and **R**eusability
within each community and across domains.

# WP5: Use cases and domains

WP1 Management

WP2 Discovery, Access and FAIR Data services

WP3 Earth Analytical Lab

WP4 Interoperability, Integration & Supporting Services

WP5 Research communities engagement: Use Cases and domains

**WP6 Dissemination, User Engagment and Outreach**

# WP5: Use cases and domains

WP1 Management

WP2 Discovery, Access and FAIR Data services

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WP4 Interoperability, Integration & Supporting Services

WP5 Research communities engagement: Use Cases and domains

Use Case 1: Earth and environment dynamics

Use Case 2: Environmental Bio-Geochemical Assets

Use Case 3: Biodiversity Observation

# WP5: Use cases and domains

WP1 Management

WP2 Discovery, Access and FAIR Data services

WP3 Earth Analytical Lab

WP4 Interoperability, Integration & Supporting Services

## WP5 Research communities engagement: Use Cases and domains

Use Case 1: Earth and environment dynamics

- Pilot 1: Coastal Water Dynamics
- Pilot 2: Earth Critical Zones
- Pilot 3: Volcano Space Observatory

Use Case 2: Environmental Bio-Geochemical Assets

- Pilot 4: Ocean Bio-Geochemical Observation

Use Case 3: Biodiversity Observation

- Pilot 5: Marine Omics Observations

# UC1 : Earth and Environmental Dynamics
# Pilot 1: Coastal Water Dynamics

**Main partners:**

- Reiner Schlitzer, Sebastian Mieruch (Alfred Wegener Institute, **DE**)
- Charles Troupin, Alexander Barth (University Liege, **BE**)
- Simona Simoncelli (Istituto Nazionale di Geofisica e Vulcanologia, **IT**)

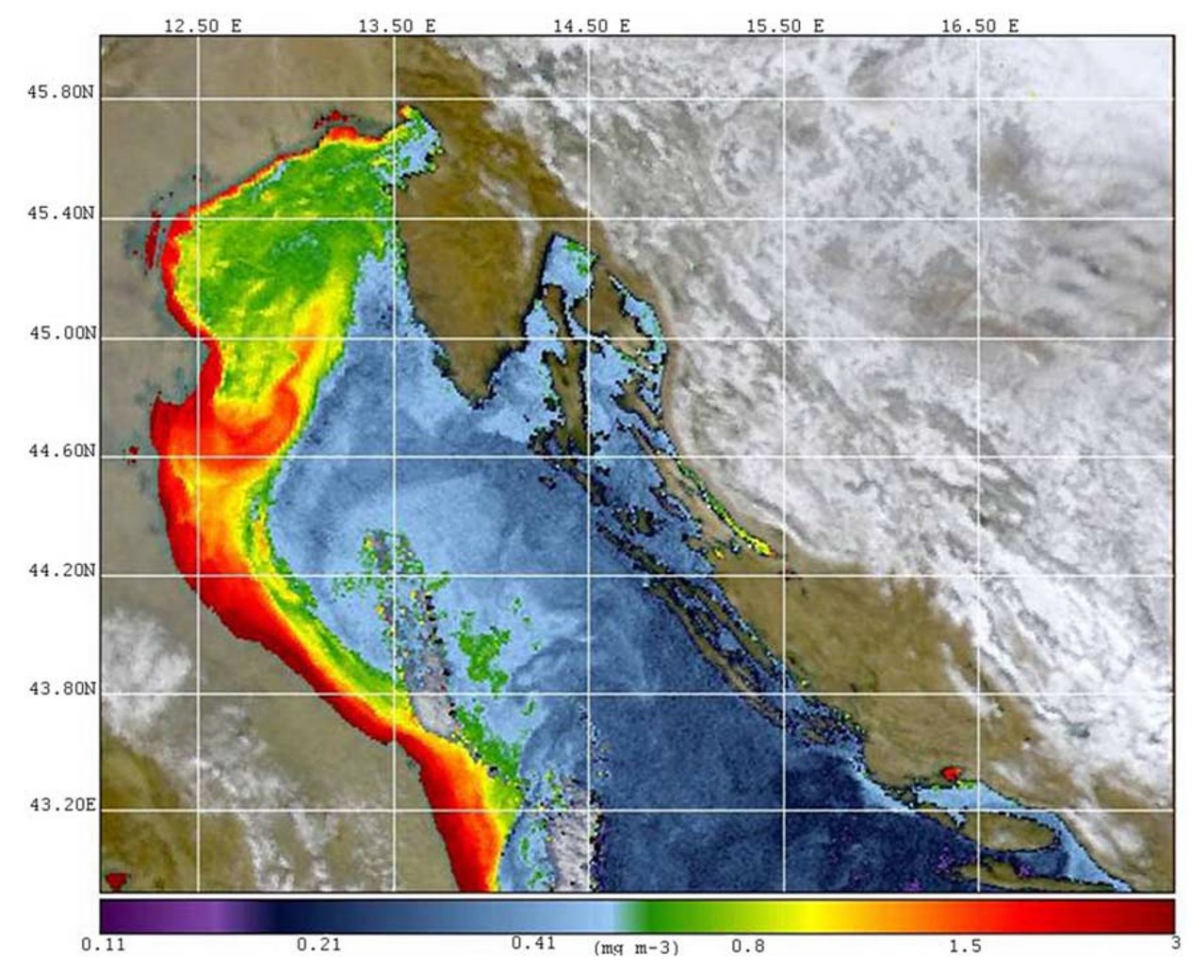
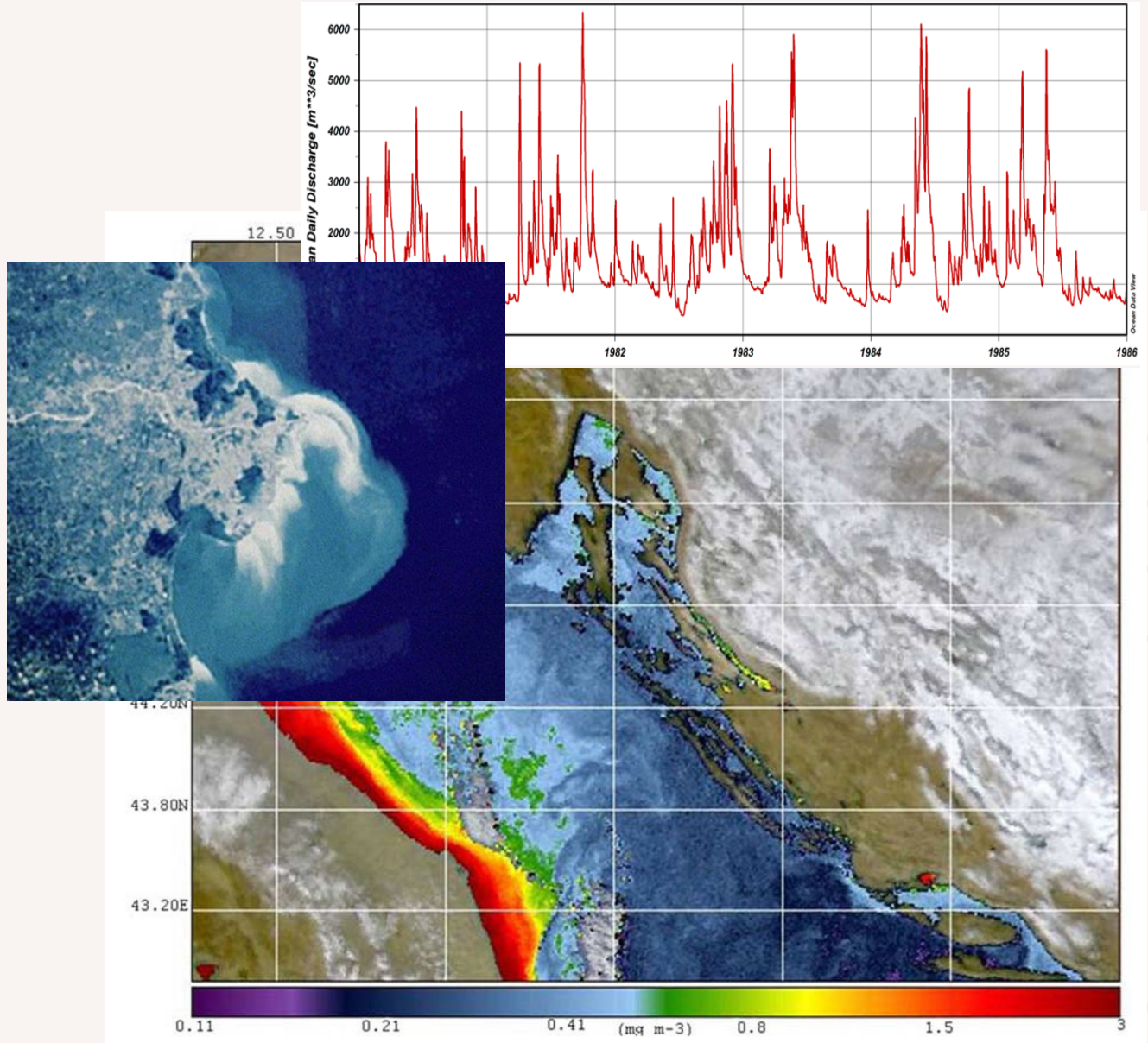



**Figure 3.** SeaWiFS image of chlorophyll concentration for 20 February 2003 (provided by NRL).

**Focus: the coastal marine environment near river estuaries**

Here important processes occurs**:**

river runoff, ocean currents, dynamics of nutrients, carbon and contaminants, meteorological changes etc.

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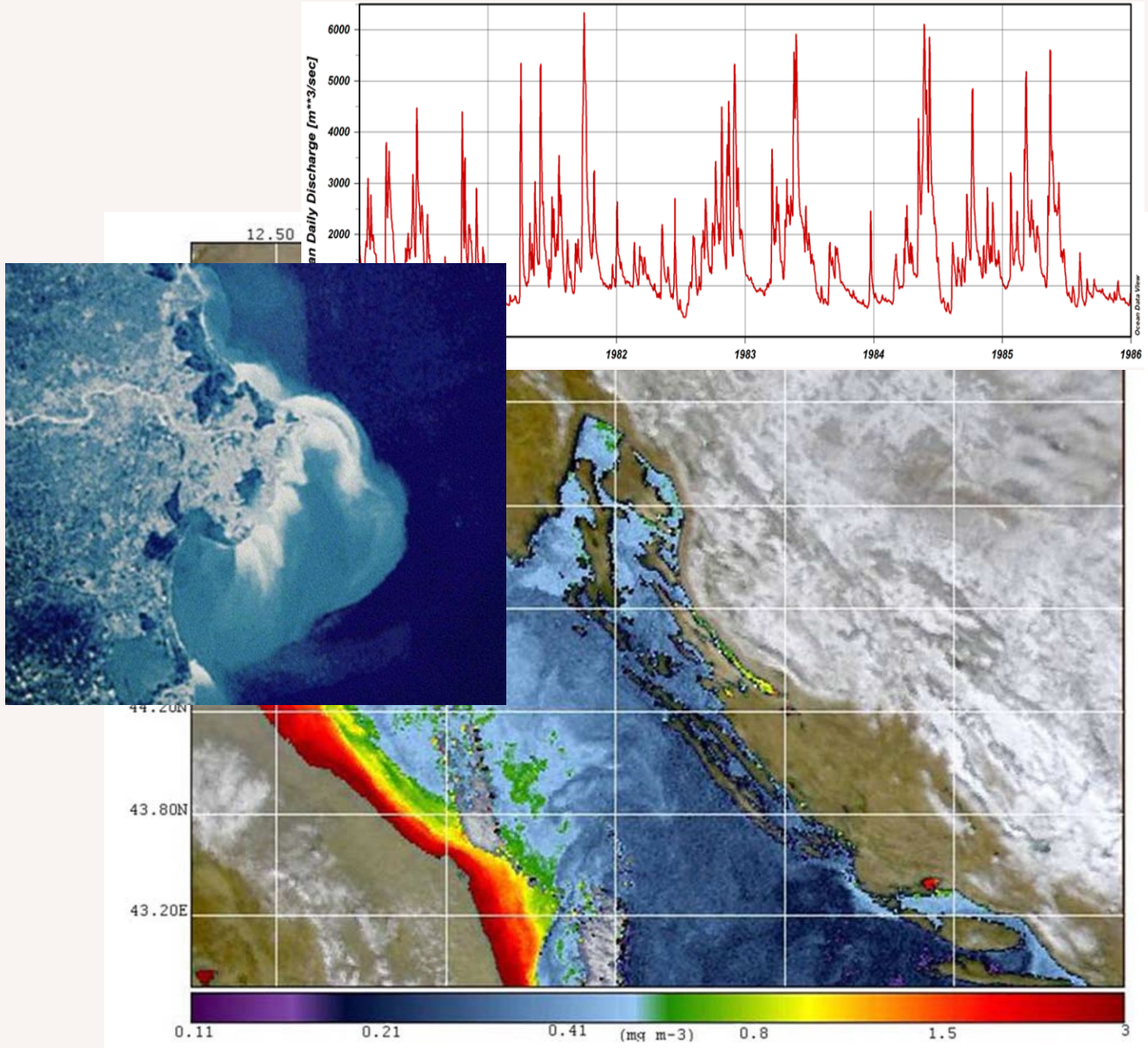
**Aims:** to develop and test innovative web based services (webODV) and tools (DIVAnd, SOURCE) to support analysis and visualization of multiple datasets and model results

Eg.: images, models, satellite, water column, physical and biogeochemical data, biodiversity data

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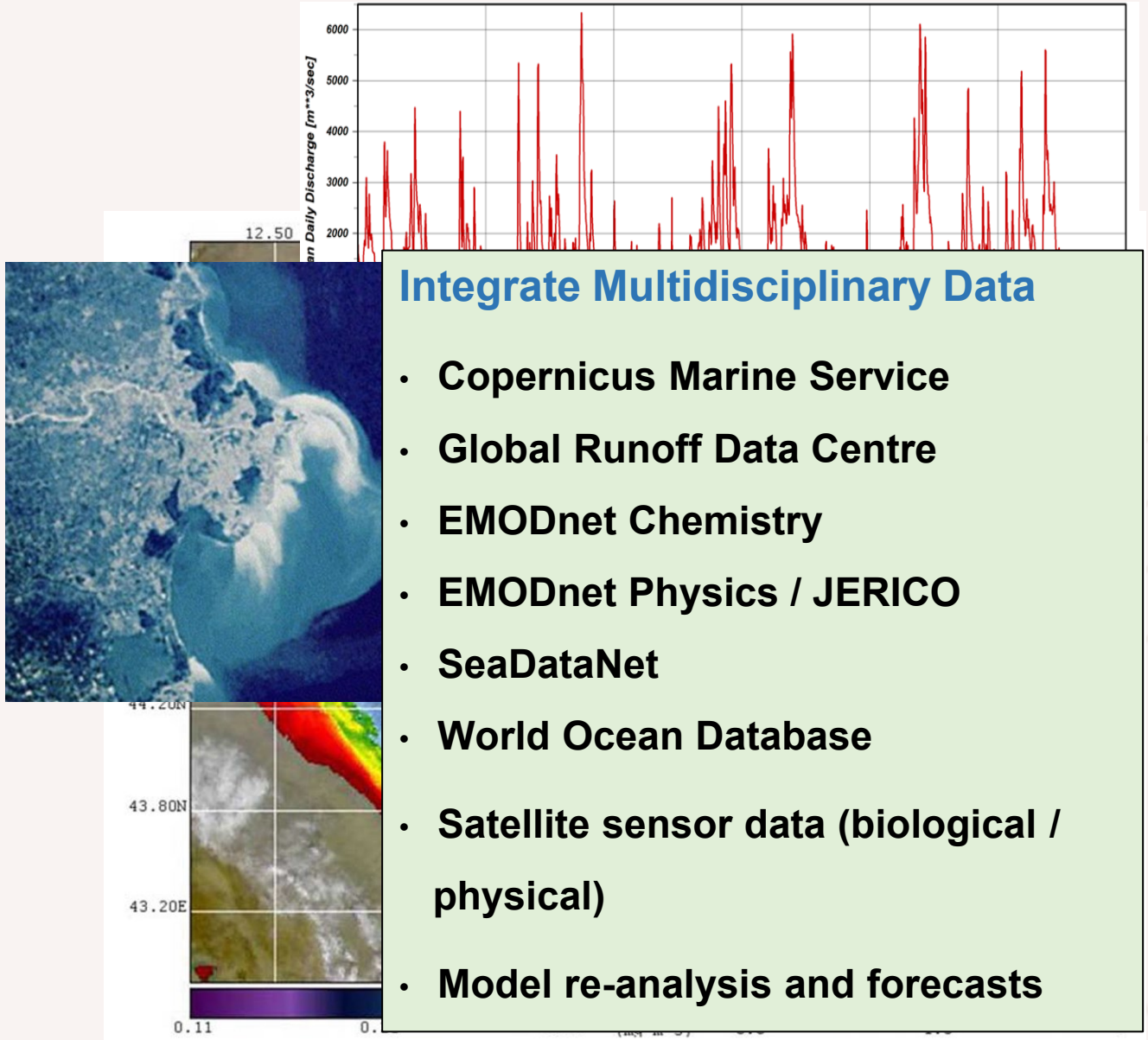


## Integrate Multidisciplinary Data

- **Copernicus Marine Service**
- **Global Runoff Data Centre**
- **EMODnet Chemistry**
- **EMODnet Physics / JERICO**
- **SeaDataNet**
- **World Ocean Database**
- **Satellite sensor data (biological / physical)**
- **Model re-analysis and forecasts**

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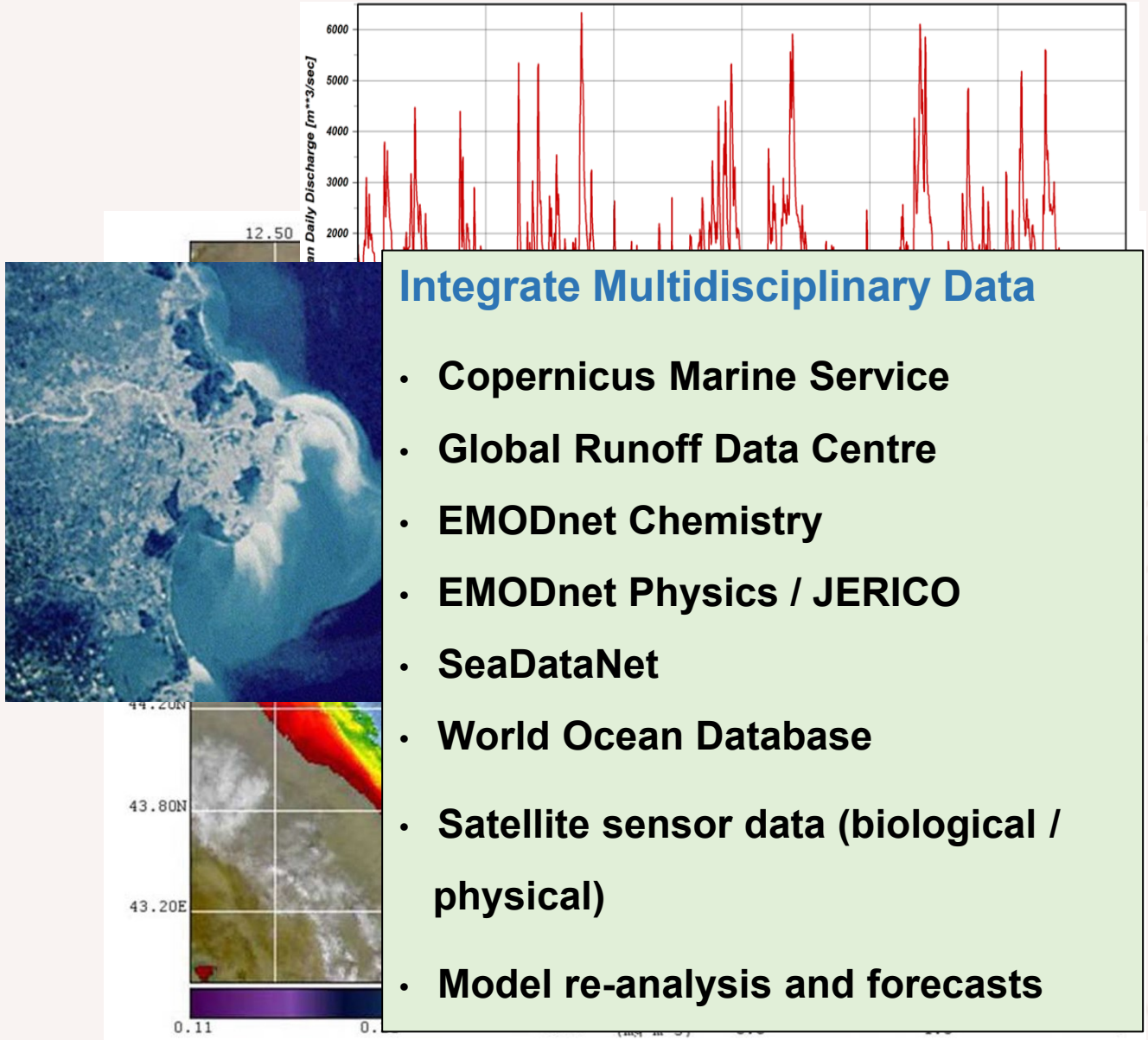


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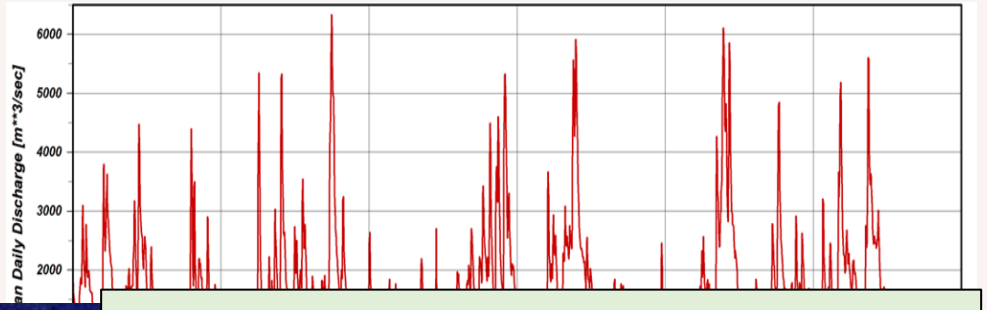


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Data gathering, Integration

Web based tools implementation

Validation & deployment

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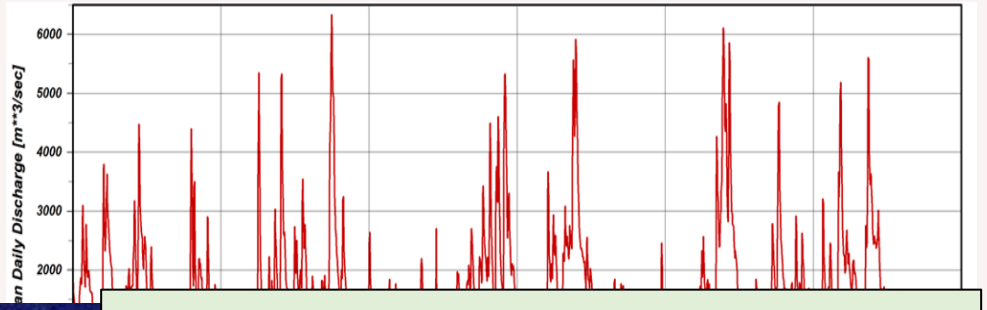
**Scientific and socio economic impacts:**

1. Facilitate model/data comparisons
2. Correlate data (eg.: satellite data (eg. Chlorophill) with river discharge)
3. Biological productivity and fish stocks
4. Uptake of atmospheric CO2 and effect on marine carbon cycle
5. Input and off-shore transport of suspended material and hazardous substances

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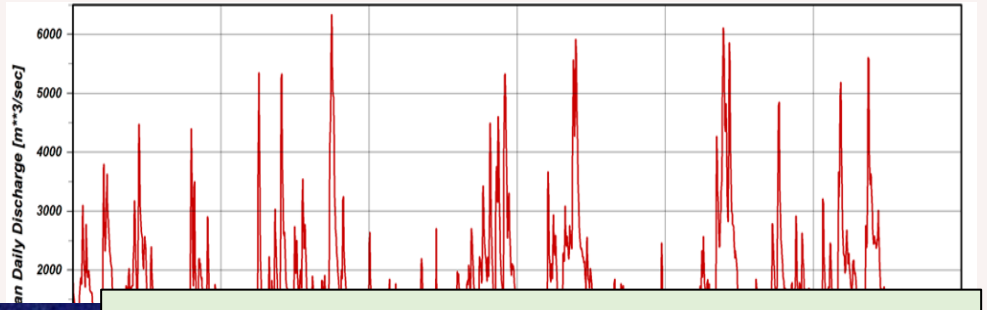


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**Targeted users:**
Scientists, Decision makers, Stakeholders, Students ….

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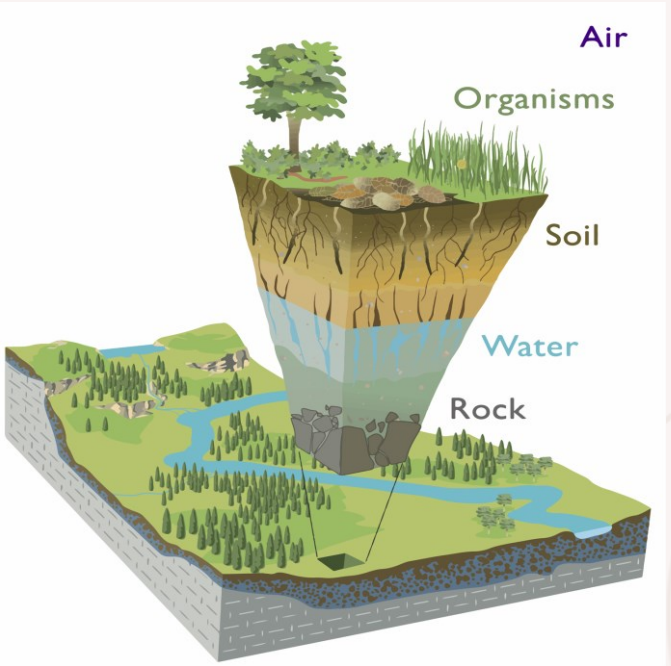
# UC1 : Earth and Environmental Dynamics
# Pilot 2: Earth Critical Zone

**Main partners:**

- Giuliano Langella (University Federico II of Naples, **IT**)
- Fabio Terribile (University Federico II of Naples, **IT**)




**Background:** The Earth Critical Zone is the assemblage of above ground and below ground layers (rock, groundwater, soil, organisms (such as vegetation), water and atmosphere)

# UC1 : Earth and Environmental Dynamics
# Pilot 2: Earth Critical Zone

**Focus: support the Sustainable Development Goals (SDG) 15.3 to assess land and soil degradation**

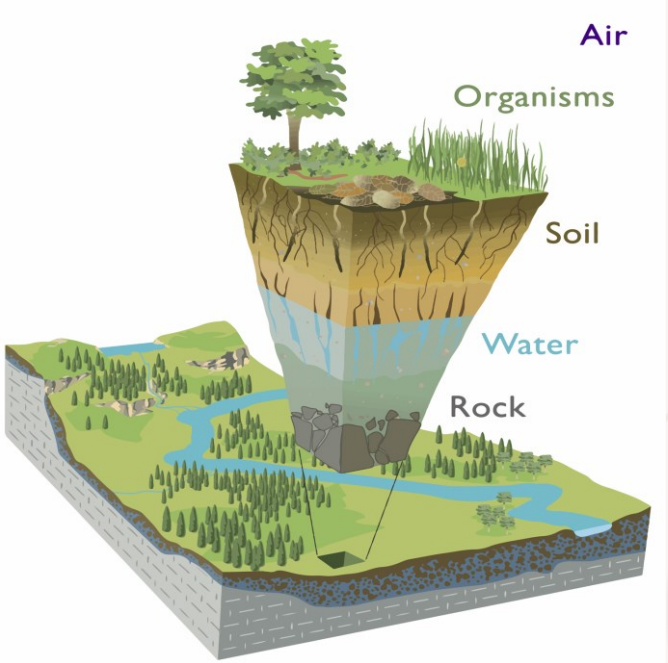
**Aims:** monitoring and validating erosion, loss of organic matter and soil biodiversity, compaction, salinization, contamination, desertification, climate change, etc. to combat and restore degraded land and soil.

**The approach:** the analysis is based on three sub-indicators: vegetation productivity, land cover changes, and soil organic carbon changes.

**Limits:** the SDG indicator 15.3.1 current approach has embedded reliability problems (e.g. resolution, procedures), raising potential controversies and misleading policy guidance.

Heterogeneous data sources

Tools ⇒ Time consuming, Low accessibility, Limited quality of resulting information



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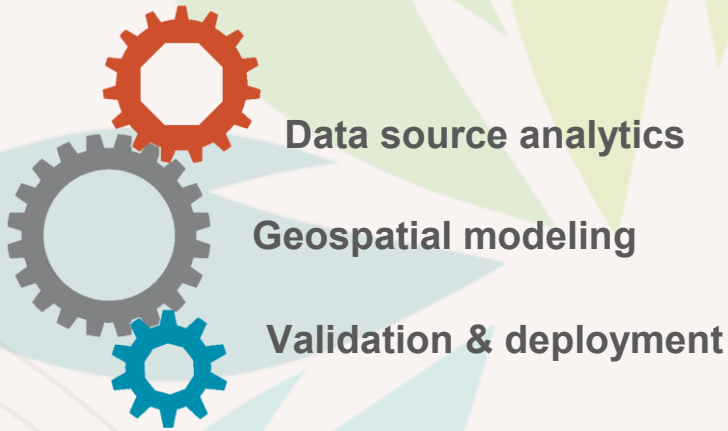


**Aims in FAIR-EASE: to implement a new land degradation tool**

It will be included in the web-based Decision Support Service called LandSupport and offered to interested policy makers and communities

**Main strategy in Fair-Ease:**

- Efficient update of algorithms embedded in the geospatial modeling pipeline (change data and/or modify model code)
- Continuous staging environment and deployment of production environment
- Enhanced access to data (remote sensing) and analytics

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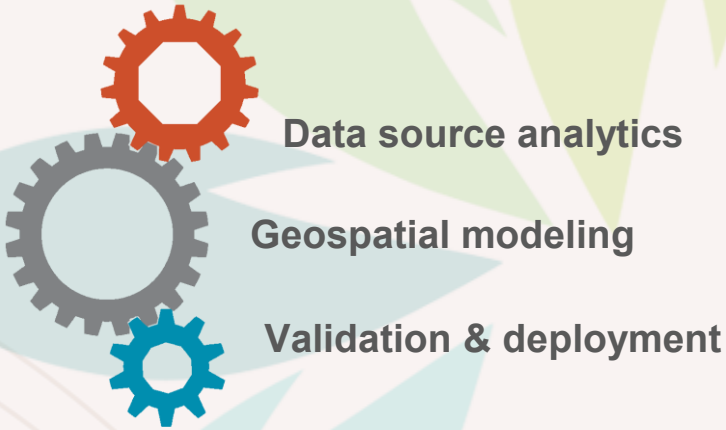


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**Targeted Users:**

Decision makers, Scientists, Students, stake holders

# UC1: Earth and Environmental Dynamics
# Pilot 3: Volcano Space Observatory

**Main partners (FR) (from Atmospheric Sciences & Solid Earth disciplines):**

- M. Boichu, Université de Lille/Laboratoire d'Optique Atmosphérique
- N. Pascal, T. Mathurin, J. Riedi, Université de Lille/AERIS-ICARE national Data and Services Center
- AERIS Atmosphere Data and Services Center
- R. Grandin, Université Paris Cité/Institut de Physique du Globe de Paris (IPGP)
- R. Grandin, ForM@TER Solid Earth Data and Services Center –
- CNRS
- DATA TERRA research infrastructure


Holuhraun eruption (Iceland)

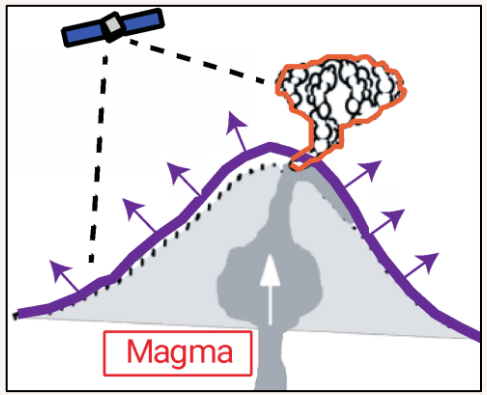
# UC1: Earth and Environmental Dynamics
# Pilot 3: Volcano Space Observatory

**Focus:** Volcano Space monitoring and observations

**Aims:** to implement a web based platform for efficient interactive aggregation and joint analyses of satellite observations from Solid Earth and Atmospheric data for the near-real-time monitoring of volcanic activity

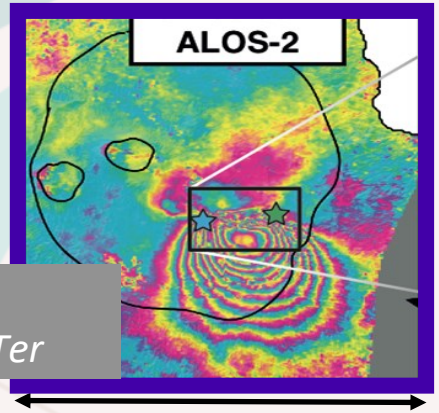
## Strategies

**Ground deformation**
- transport & magma storage
- volume budget




**Gas-particle emissions**
- Magma composition, flux
- mass budget

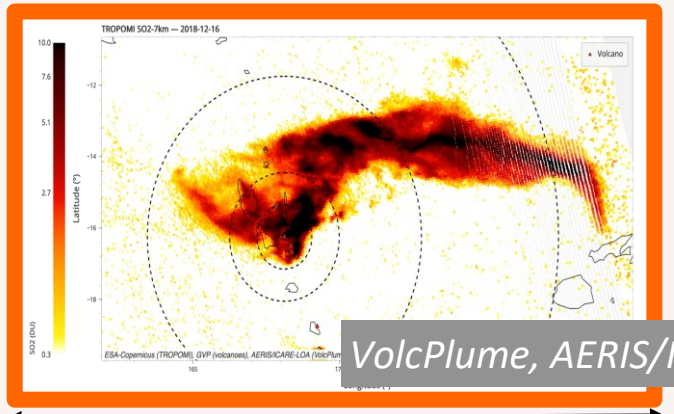
InSAR




*IPGP*
*ForM@Ter*

20 km
pixel size = 1–100 m
Revisit time: ~ 6 days

TROPOMI/IASI/OMPS $SO_2$




*VolcPlume, AERIS/ICARE-LOA*

1000 km
pixel size = 5–25 km
Revisit time: 12 or 24 hours (LEO)/ 20 min (GEO)

InSAR: Interferometric Synthetic Aperture Radar

Tropomi/OMPS: UV-vis/scattered solar radiation spectra in the near and/or short wave infrared
IASI: thermal infrared Atmospheric Sounding interferometer

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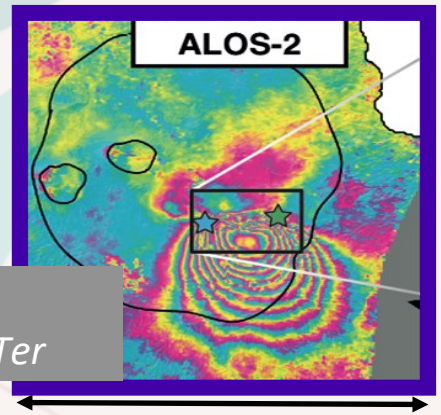


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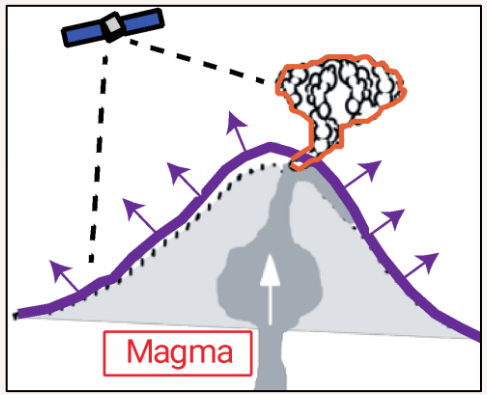


**Current limits:**
Time consuming
Efficient Data Access

**Gas-particle emissions**
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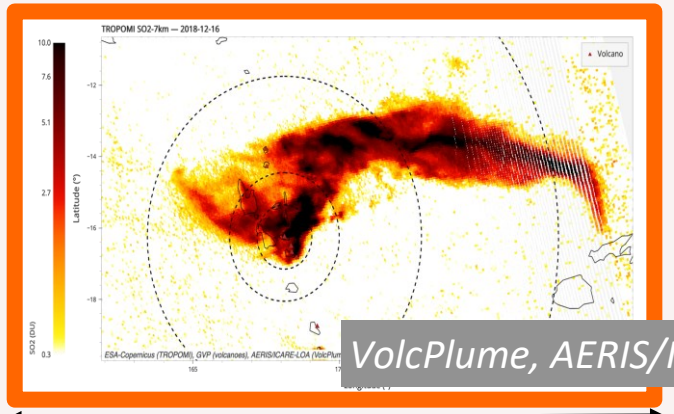


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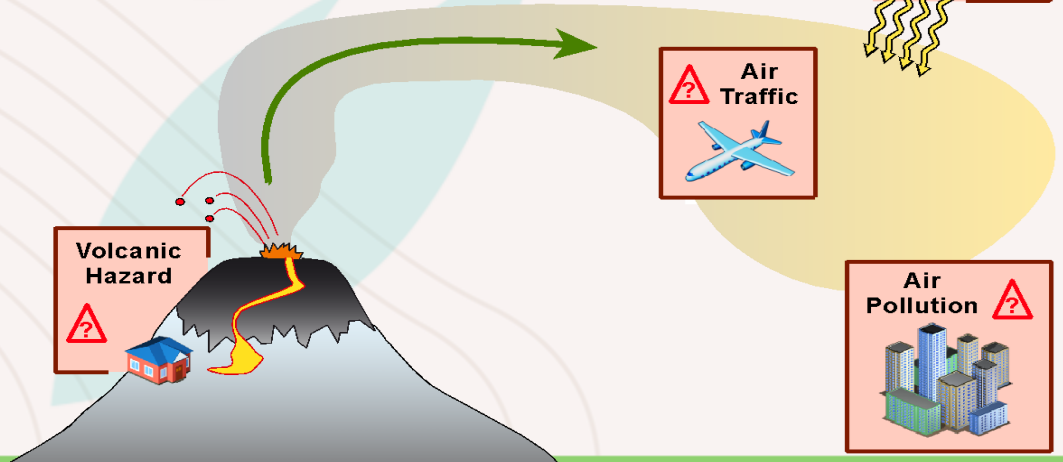
# UC1: Earth and Environmental Dynamics
# Pilot 3: Volcano Space Observatory

**Impact: monitoring and understanding**

- volcanic activity to help **hazard assessment**, especially during explosive eruptions that may destroy ground instruments
- **air quality and aviation safety**
- **large-scale and long-term impacts on atmosphere and climate**

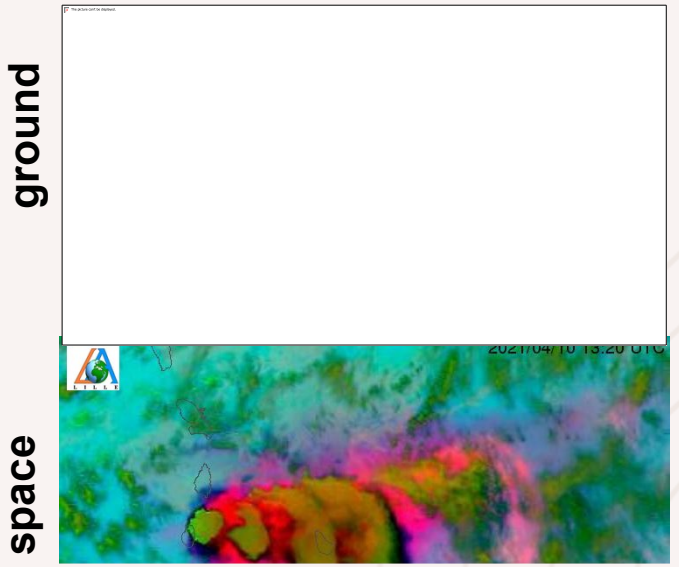



Efficient Data access and integration

Web based tools implementation

Validation & deployment

**2021**
**La Soufrière eruption (Antilles)**



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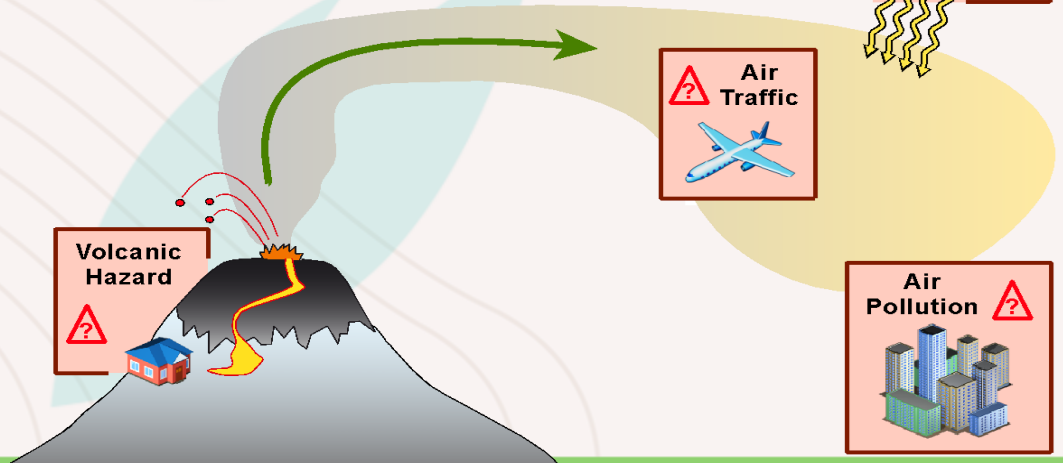


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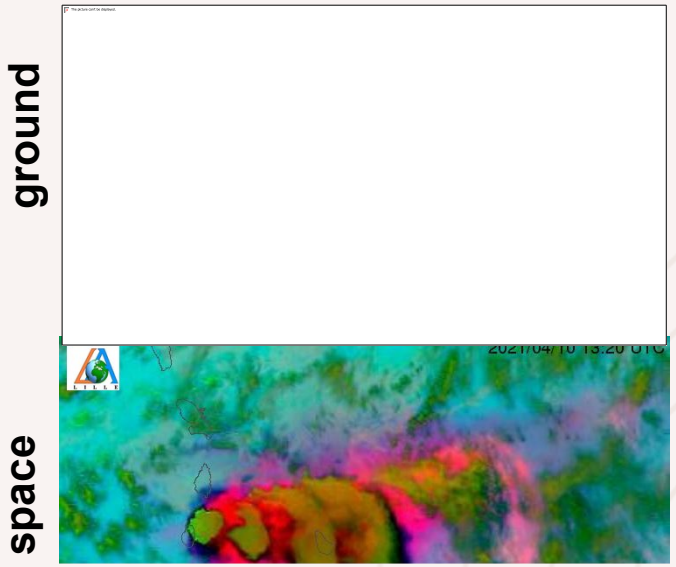
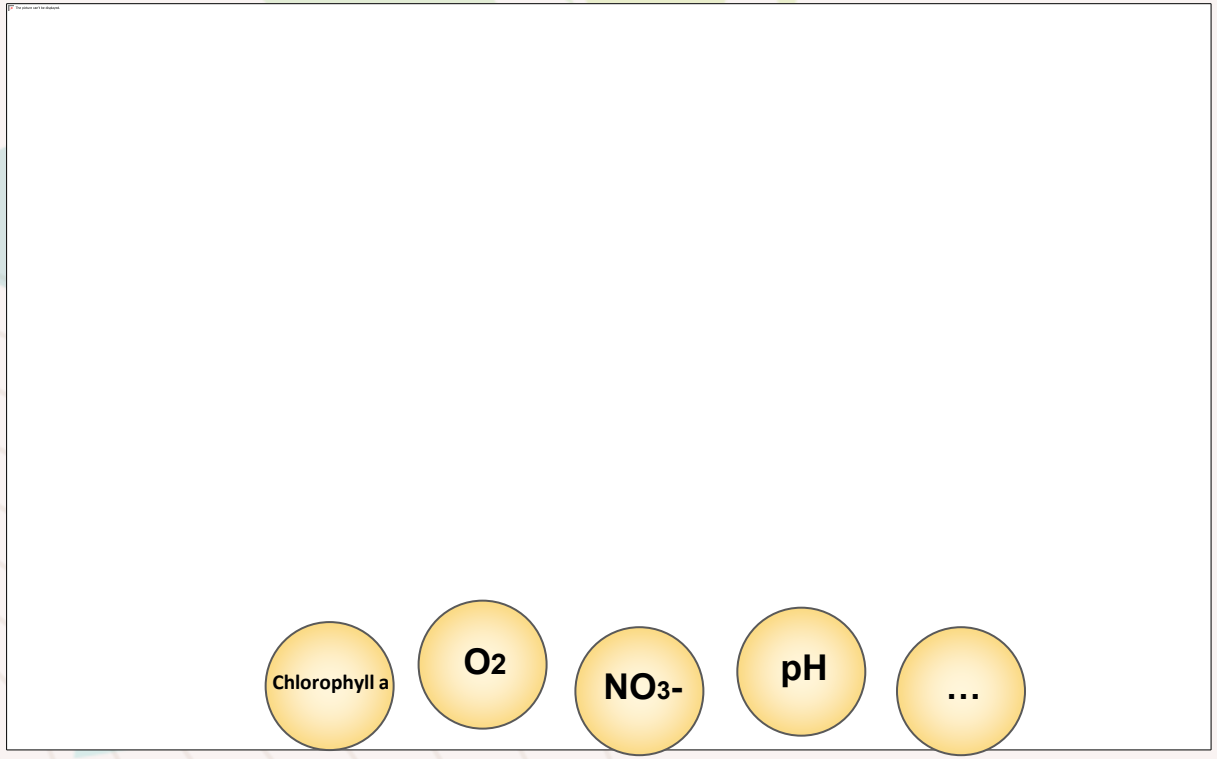


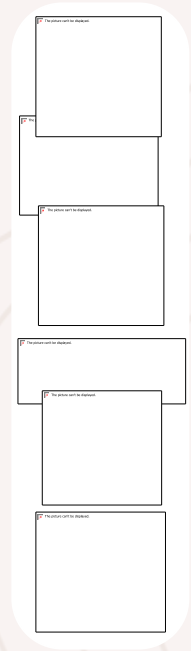

**Targeted users:**
**Volcano observatories** worldwide
**Scientists, Policy makers, other Stakeholders**

# UC2: Environmental Bio-geochemical Assets
# Pilot 4: Ocean Bio-Geochemical Observation




**Main partners:**

- Virginie Recapé, Clément Weber & Alban Sizun (**Pokapok, FR**)
- Claire Gourcuff (**Euro-Argo, FR**)
- Catherine Schmechtig, Raphaëlle Sauzède (**CNRS**-*Centre National de la Recherche Scientifique*, **FR**),
- Erwan Bodéré, Thierry Carval, Jérôme Detoc (**Ifremer**-*Institut Français de Recherche pour l'Exploitation de la Mer*, **FR**),
- Alessandra Giorgetti, Catalina Reyes (**OGS**-*Istituto Nazionale di Oceanografia e di Geofisica Sperimentale*, **IT**),
- Fabio Conversano, Marco Miralto (**SZN**-*Stazione Zoologica Anton Dohrn,* **IT**)



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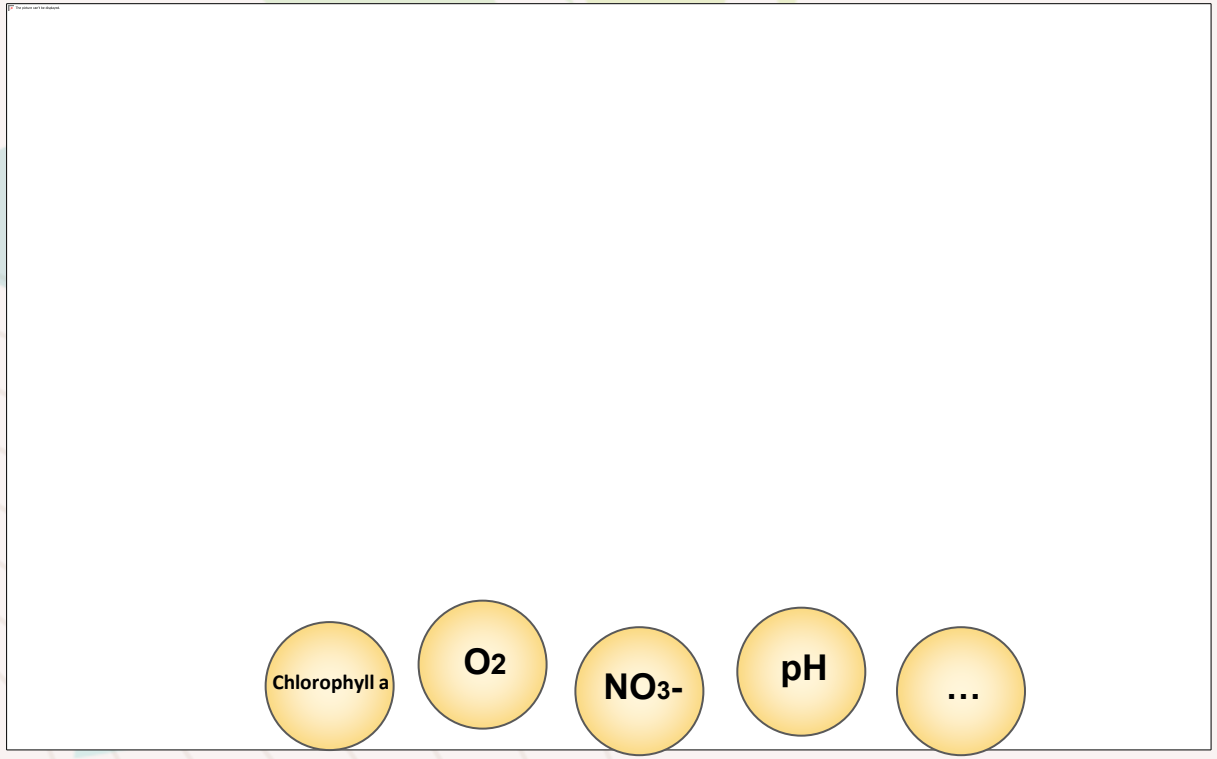
# Pilot 4: Ocean Bio-Geochemical Observation



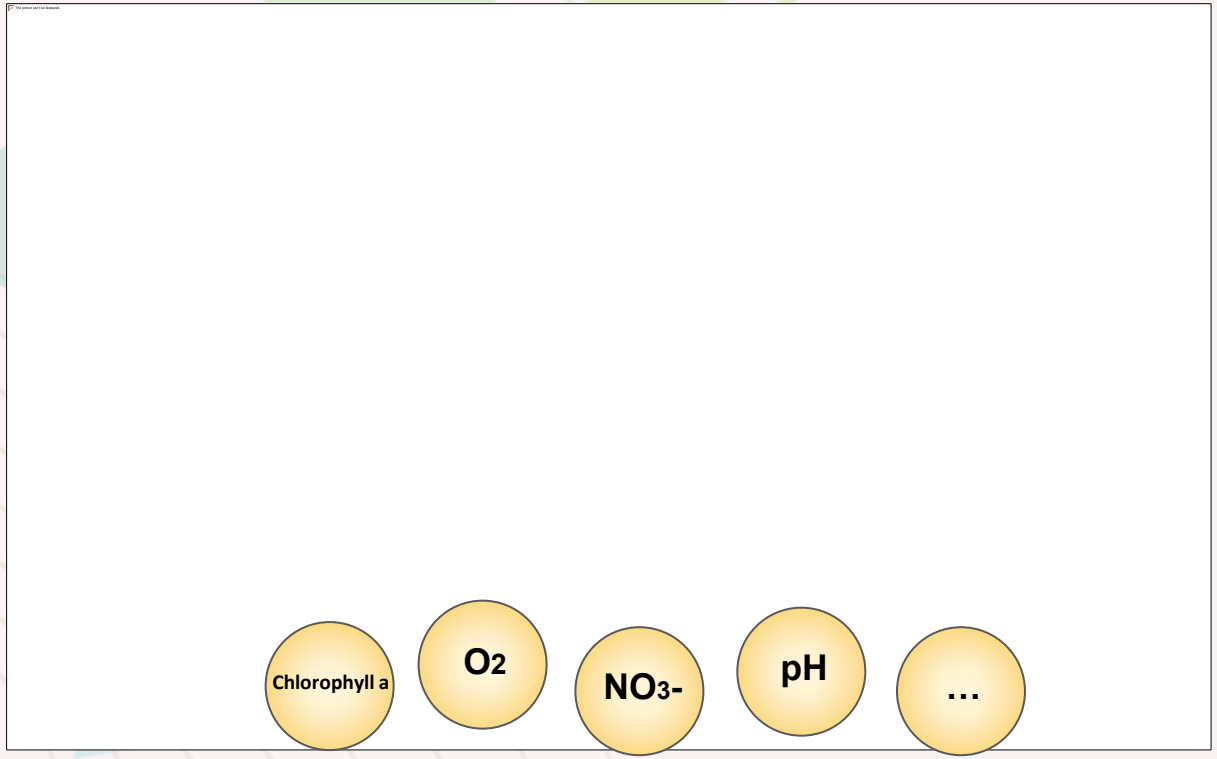

**Focus: assessment of the bio-geochemical asset in the oceans**

to understand processes involving marine ecosystems, their dynamics and impact

-on the **abiotic compartments** (e.g. ocean acidification, oxygen minimum zone, biological carbon pump)

-on the health status of **biotic compartment** (distribution of the plankton communities, etc.).

# UC2: Environmental Bio-geochemical Assets
# Pilot 4: Ocean Bio-Geochemical Observation

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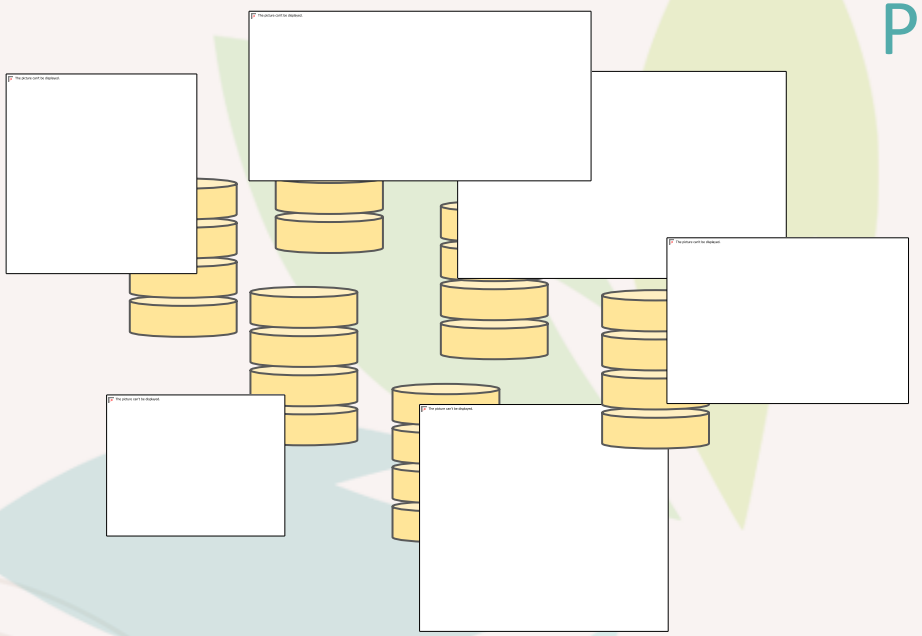
**Background:** BGC sensors in the ocean are available on various platforms (floats, gliders, sea mammals, moorings, etc.), deployed by observing networks under the GOOS-OCG (Global Ocean Observing System - Observations Coordination Group)

# UC2: Environmental Bio-geochemical Assets
# Pilot 4: Ocean Bio-Geochemical Observation



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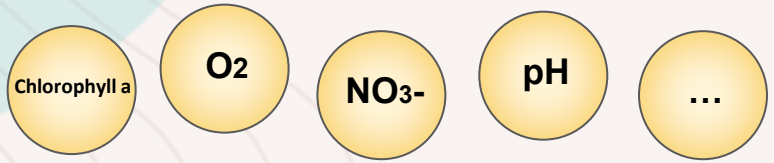

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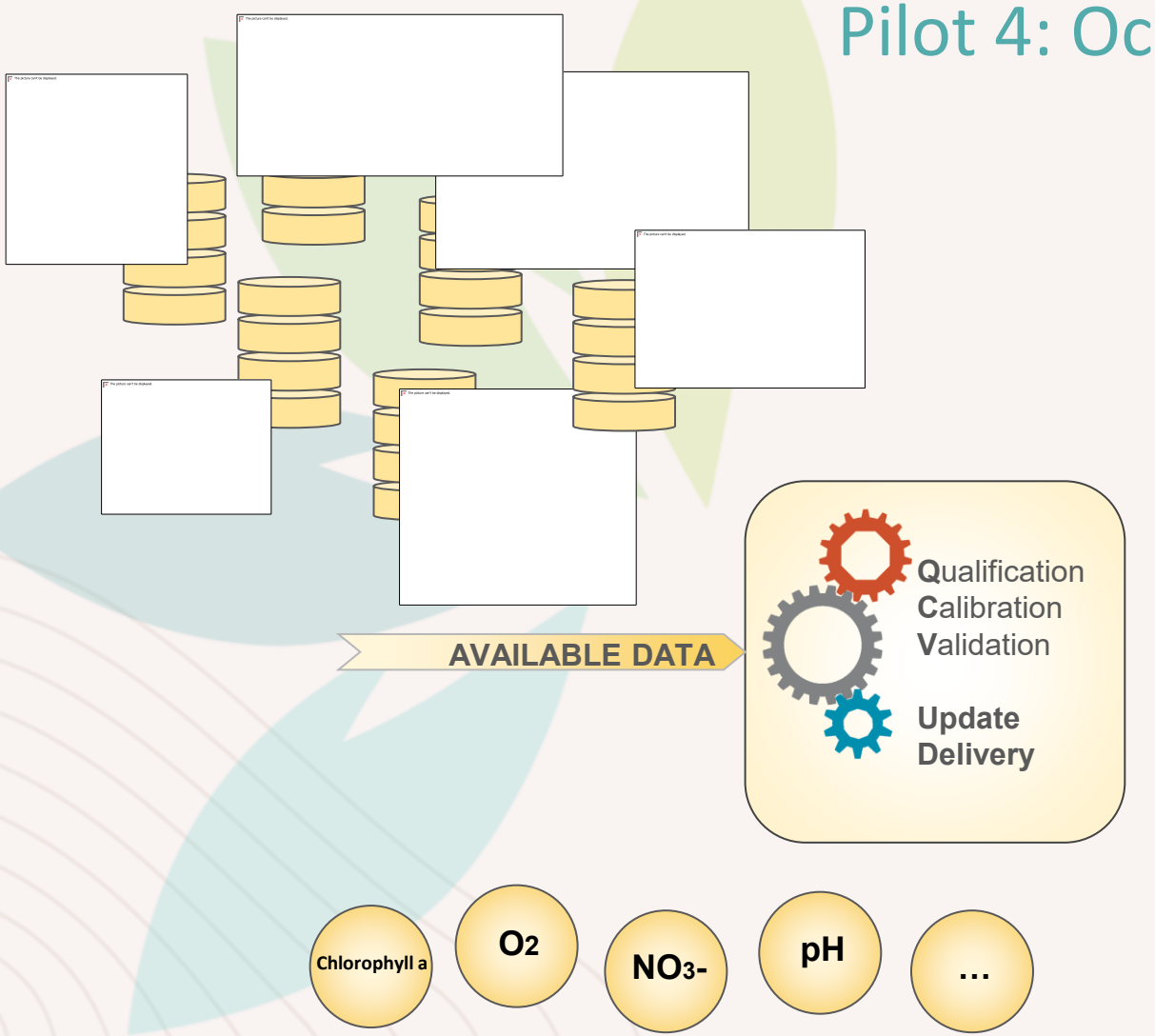

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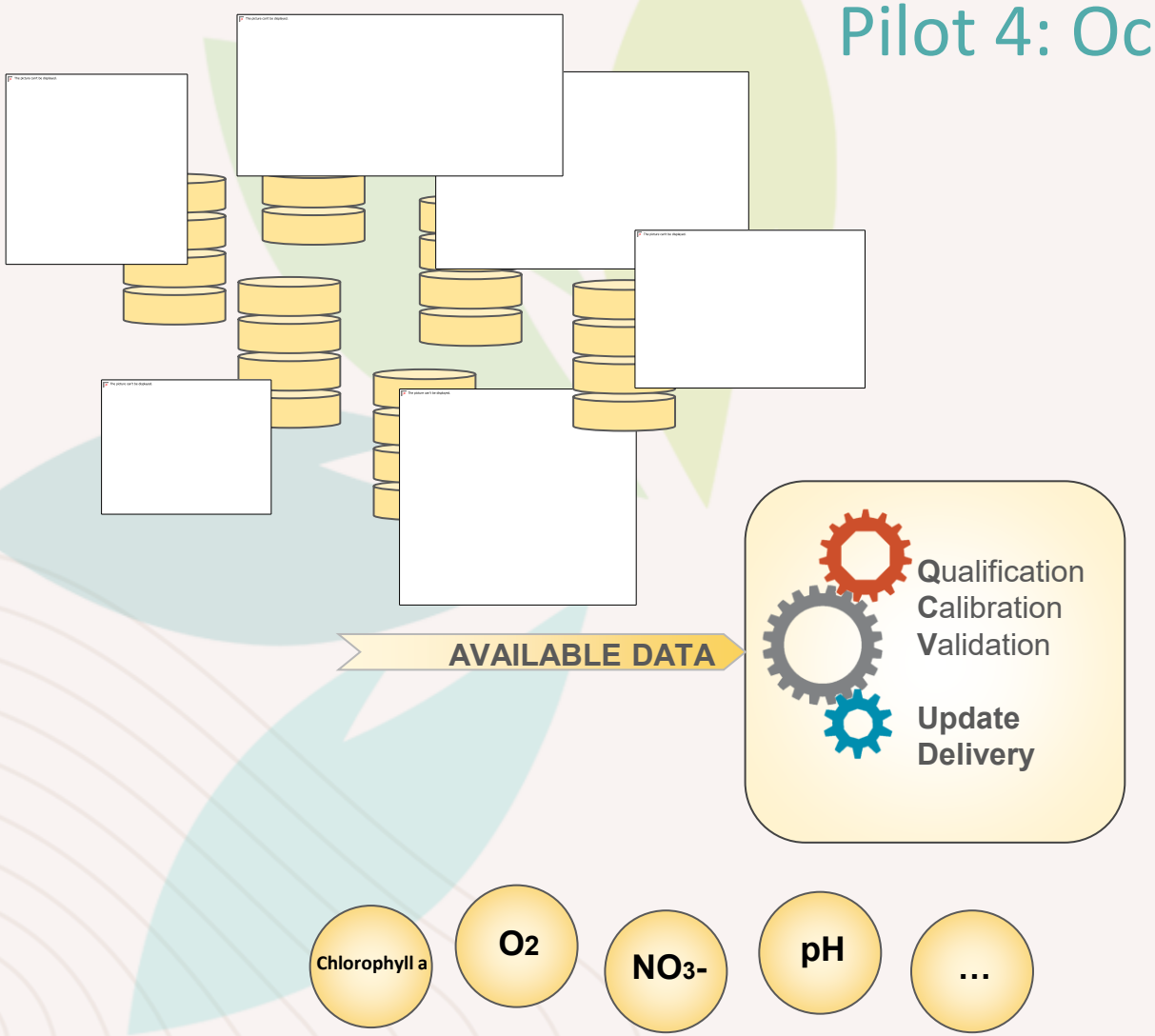


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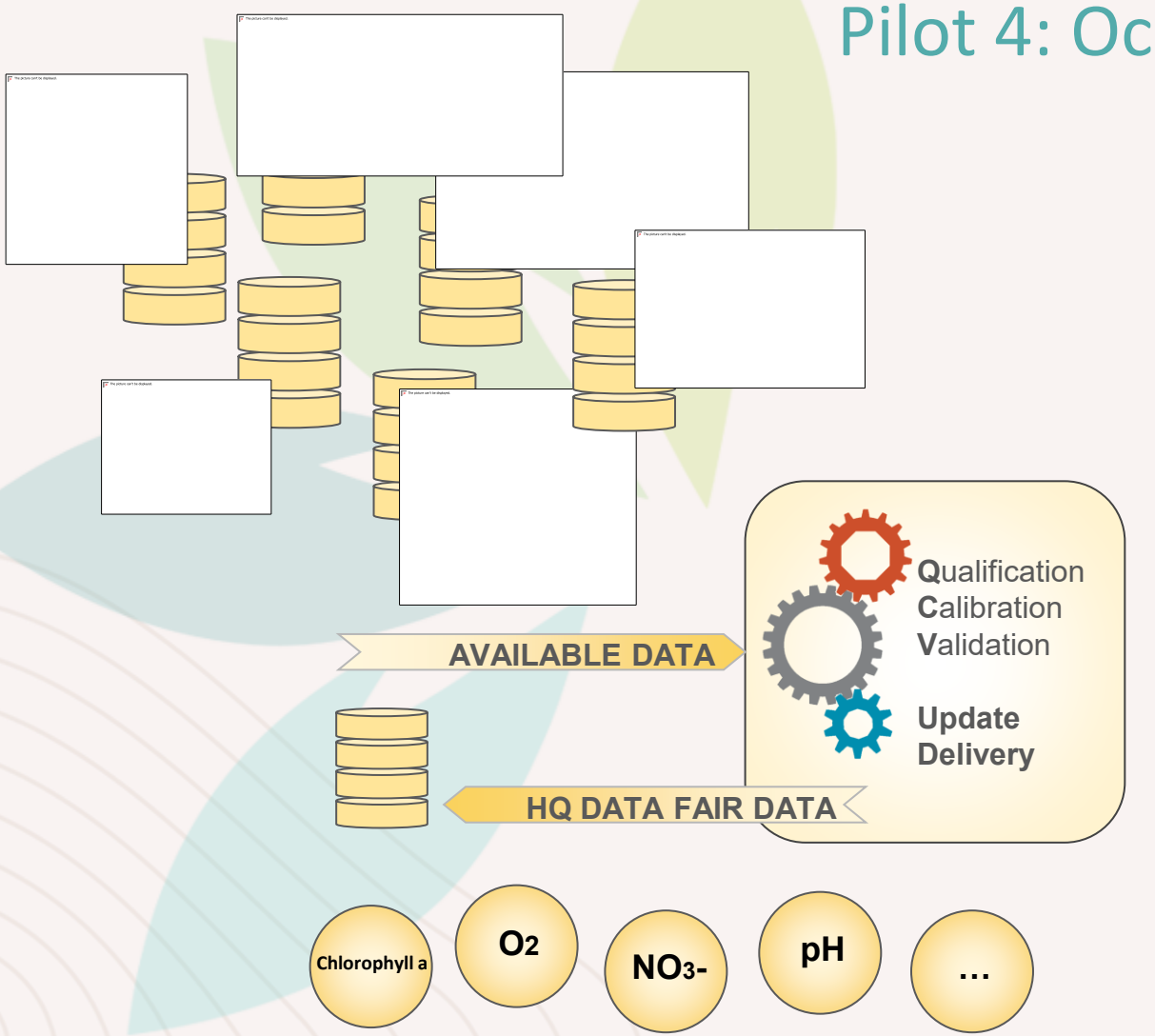


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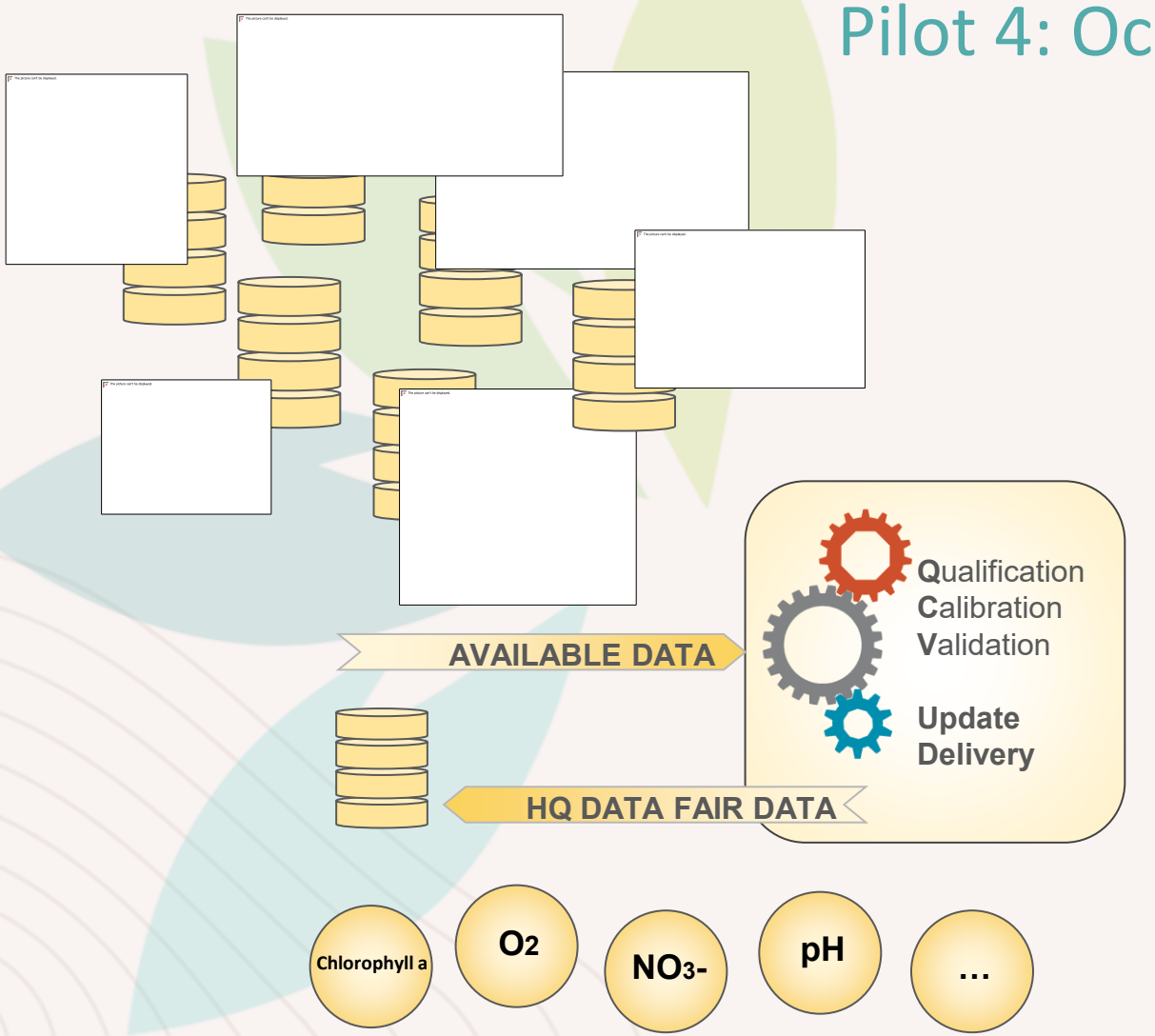


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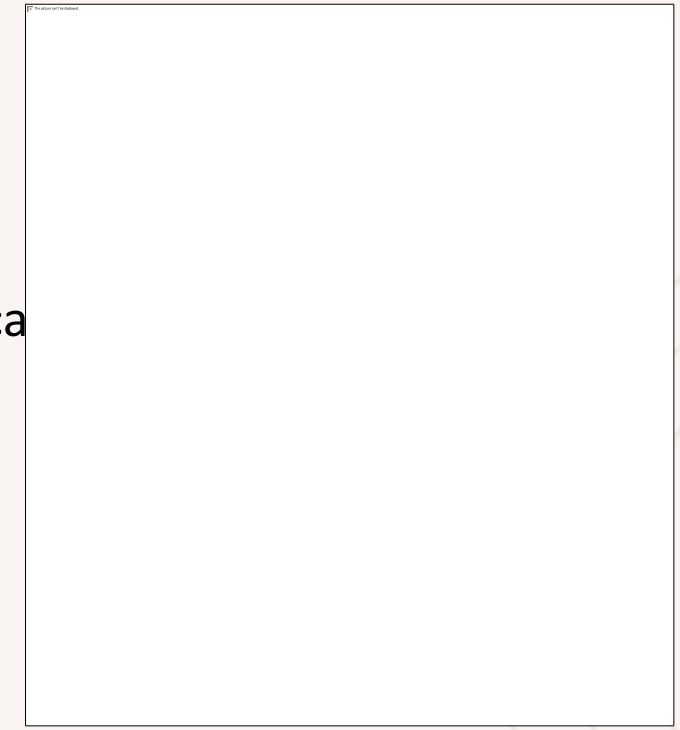
Scientists, Decision makers, Stake holders, Students

# UC3: Biodiversity Observations
# Pilot 5: Marine Omics Observations

## Main partners involved:

Cymon Cox (**Centro de Ciências do Mar, PT**)
Ioulia Santi (European Marine Biological Resource Center HQ,**FR**)
Katrina Exter (Vlaams Instituut voor de Zee,**BE**)
Marc Portier (Vlaams Instituut voor de Zee,**BE**)
Maria Luisa Chiusano (University Federico II of Naples and Stazione Zoologica Anton Dohrn, **IT**)
Stelios Ninidakis (Hellenic Centre for Marine Research,**GR**)

European Marine Biological Resource Centre (**EMBRC**-ERIC)



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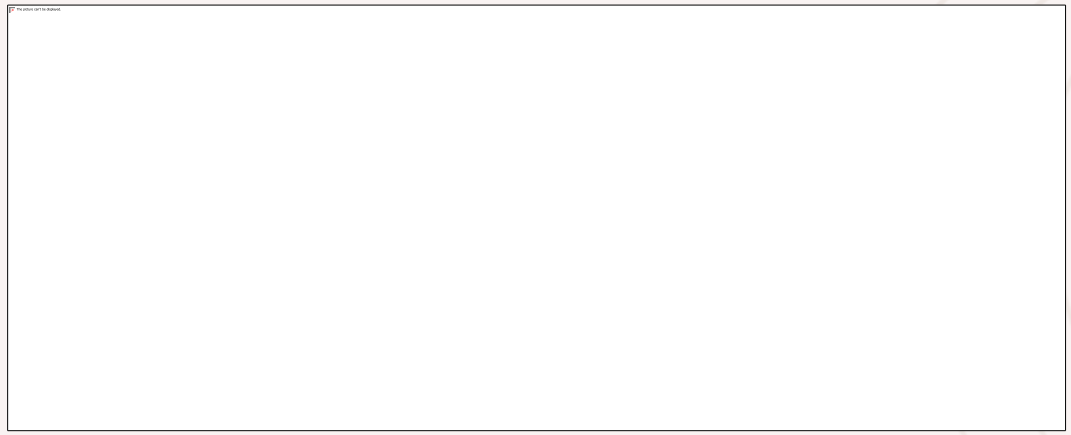
**Focus:** the exploitation of marine metagenomic data and eDNA for Biodiversity assessments

**Background:** The European Marine Omics Biodiversity Observation Network (EMO BON) in EMBRC



# UC3: Biodiversity Observations
# Pilot 5: Marine Omics Observations

**AIMS in FAIR EASE:**

Standardisation: of SOP's, analytical workflows, FAIR data

Generate inventories (RO-crates)

Design a suitable Virtual Research Environment for

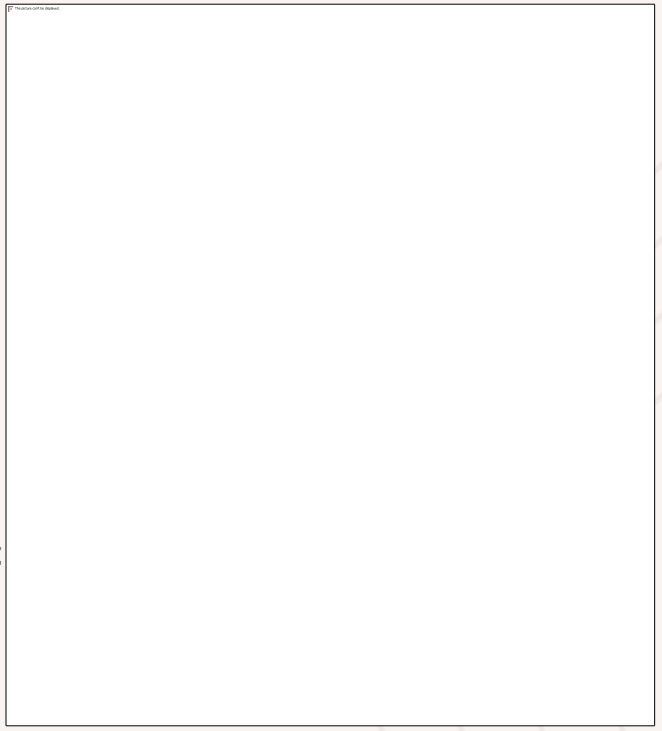
- data dissemination
- data visualisation and exploration
- improve data analysis workflows

  through interoperability with external data sources: GBIF, SeadDataNet, EMODNet

Design Data access and integration

Tuning on workflows

Validation & deployment



# UC3 : Biodiversity Observation
# Pilot 5: Marine Omics Observations

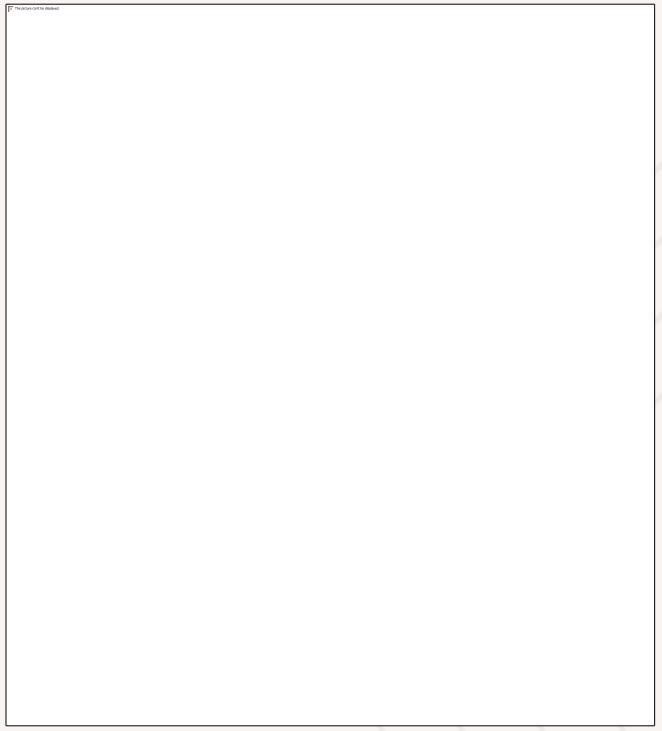
**Impact:** To understand marine ecosystem supported by omics data exploitation for applications on:

1) the exploration of biodiversity in space and time in European coastal habitats

2) the creation of targeted ecosystem services to tackle major environmental issues related to impacts on biodiversity

3) to sample microbial marine biodiversity (eDNA metagenomics) and contribute indicators

4) taxonomical, ecological and bioprospecting studies



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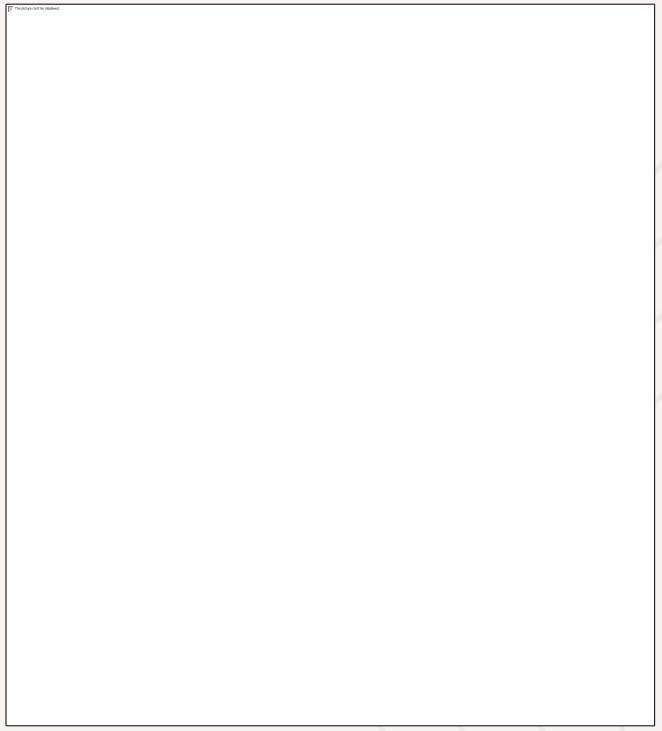

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# FAIR-EASE challenges

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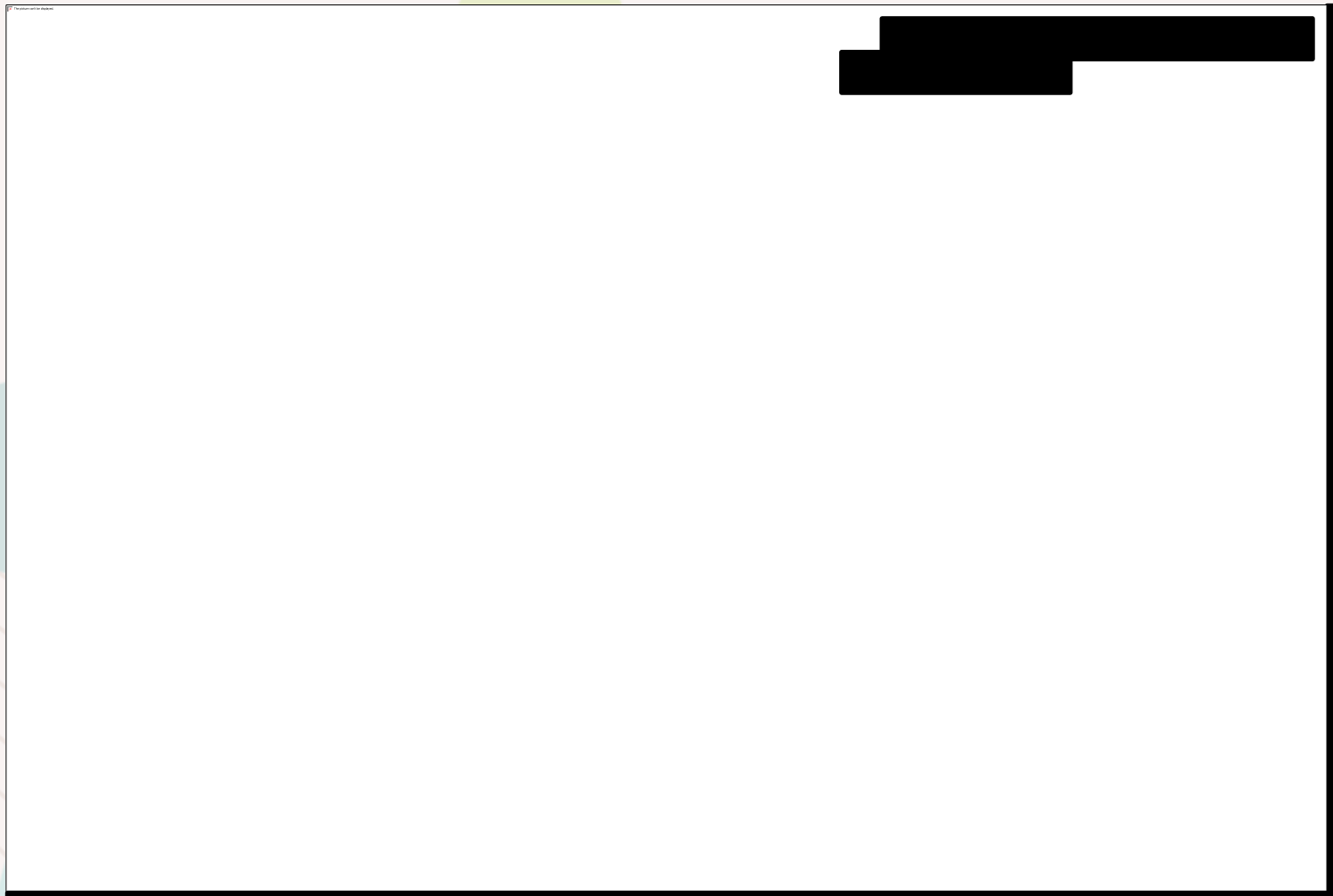


Solid Earth
- Earth Critical Zone
- Volcanos

Hydrosphere
- Ocean
- Rivers
- Water Resources

Atmosphere
- Composition

Biosphere
- Distribution

**Data access, gathering, integration, delivery**

**Efficient Methods**
**Web based tools**

**Validation & deployment**

Remote or direct sensing/sampling from public resources

Images, numerical data, text, … molecular sequences
raw, processed, model data …..

# FAIR-EASE operative framework

WP1 Management

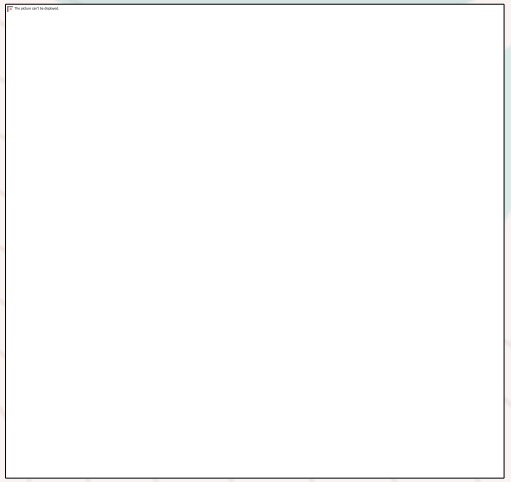
WP2 Discovery, Access and FAIR Data services

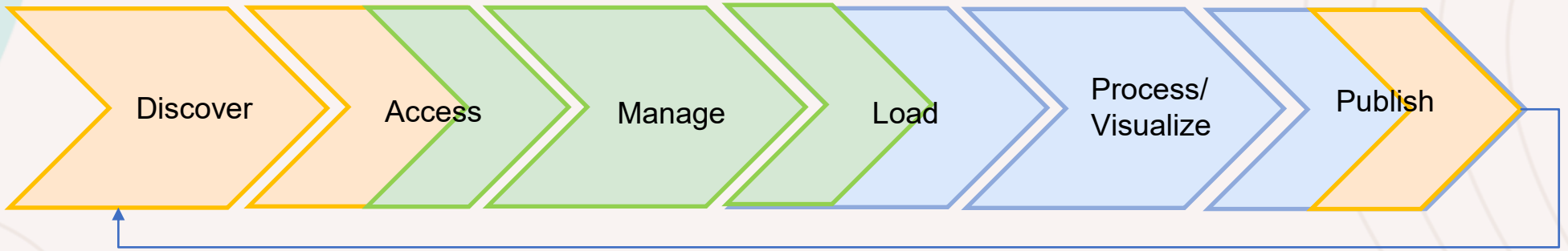
WP3 Earth Analytical Lab

WP4 Interoperability, Integration & Supporting Services

WP5 Research communities engagement: Use Cases and domains

**WP6 Dissemination, User Engagment and Outreach**





# FAIR-EASE objectives

FAIR-EASE will test methodological and technical challenges posed by pilots using multiple heterogeneous data, from soil, hydrosphere, atmosphere, biosphere, directly involving domain and technical experts, sharing knowledge and expertises -> **Reuse first, Re-do if necessary**

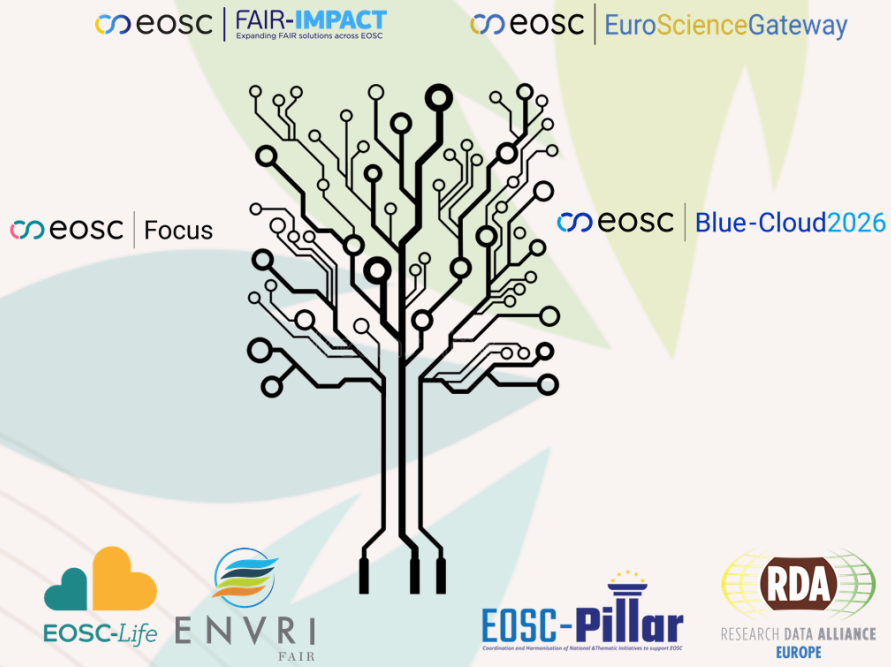
It will favour efficient finding, access, gathering, analytics (processing, calibration, modelling …), and delivery

Tools and services will be organized in the framework of the **FAIR-EASE Earth Analytical Lab** (EAL)
producing a set of thematic services and possibly a one stop shop to the infrastructure

It will improve accessibility, reusability and integration of data and software exploiting **FAIR principles**.

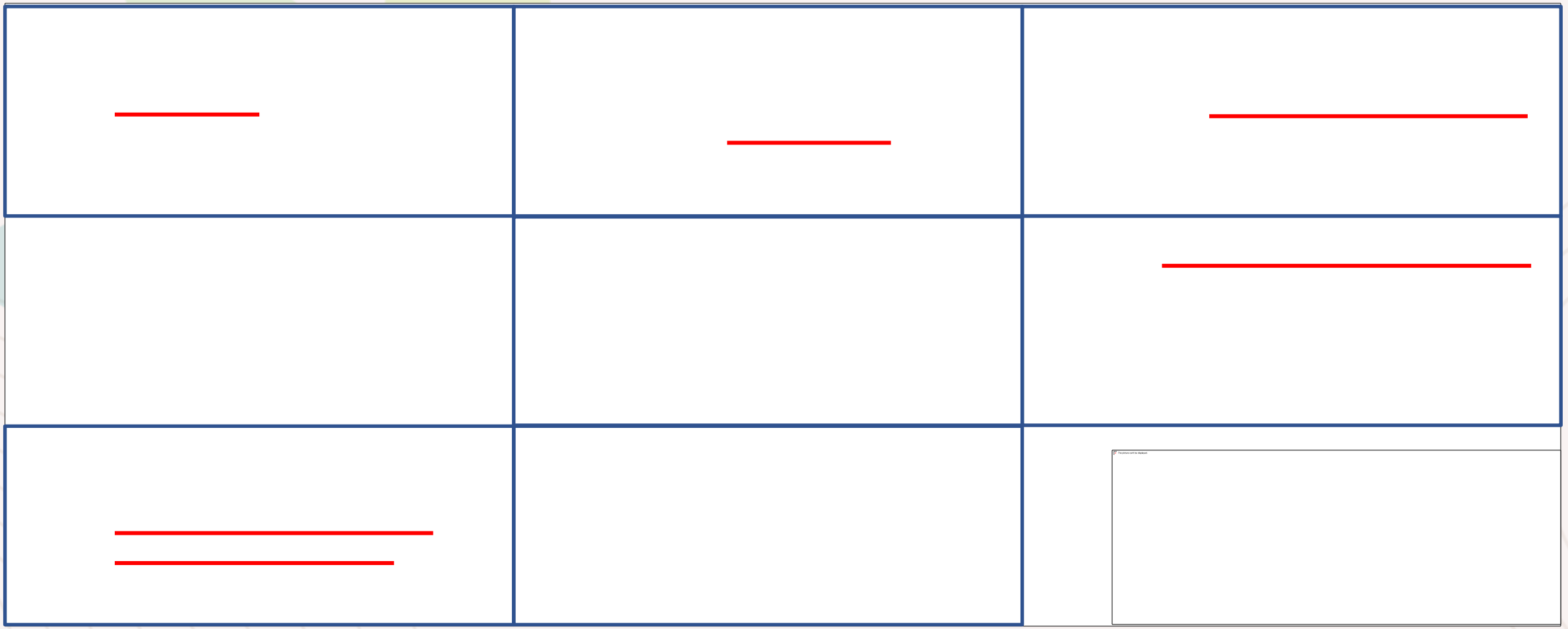
It will focus on **user engagement** and **dissemination** thanks to
application of FAIR principles
cooperation with use cases
and involvement of research infrastructures (DATATERRA, EMBRC, LANDSUPPORT…..)
**->Share, Improve, Practice and Disseminate**

# The FAIR-EASE approach is favoured by




- the tackling of real life challenges at different informative levels (ENVRI, EOSC-LIFE) related to the Earth ecosystem
- a federation of resources at both transnational and European levels to boost the sustainability of projects results
- the EOSC multiplier effect of collaborative opportunities and sharing of knowledge and efforts **->Share, Improve, Practice and Disseminate**
- the interaction with projects, deploying the same phylosophy of -> ***Re-use first, Re-do if necessary***
- the research communities' engagement as a building block for Open Science
- the involvement of research infrastructures (EMBRC, DATATERRA, LANDSUPPORT)

# The FAIR-EASE approach is favoured by and will contribute to the EOSC marketplace



# Relevant actions in FAIR-EASE

To do:

To move from concept to practice:

- data findability, interoperability, reusability
- face computational challenges in a multifaceted integrated framework (infrastructure implementation)

To still improve:

- language and communication barriers

To fully exploit:

- trans-domain interoperability

To appropriately plan:

- sustainability of actions and resources also to guarantee long terms collaborations

# Relevant actions in FAIR-EASE

Exploiting long term **trans-domain** interactions will:

- **Enhance the sharing of expertises, knowledge, resources** and **standards** to face big challenges;
- **Favour the tuning on computational strategies** and **requirements** to improve methodological and technological asset;
- **Promote interoperability** and **synergies** emerging from a transdisciplinary effort

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**GOAL: to offer competitive**  **solutions in** 

# Acknowledgements

Fair-EASE pilot members

Fair-EASE and associated partners

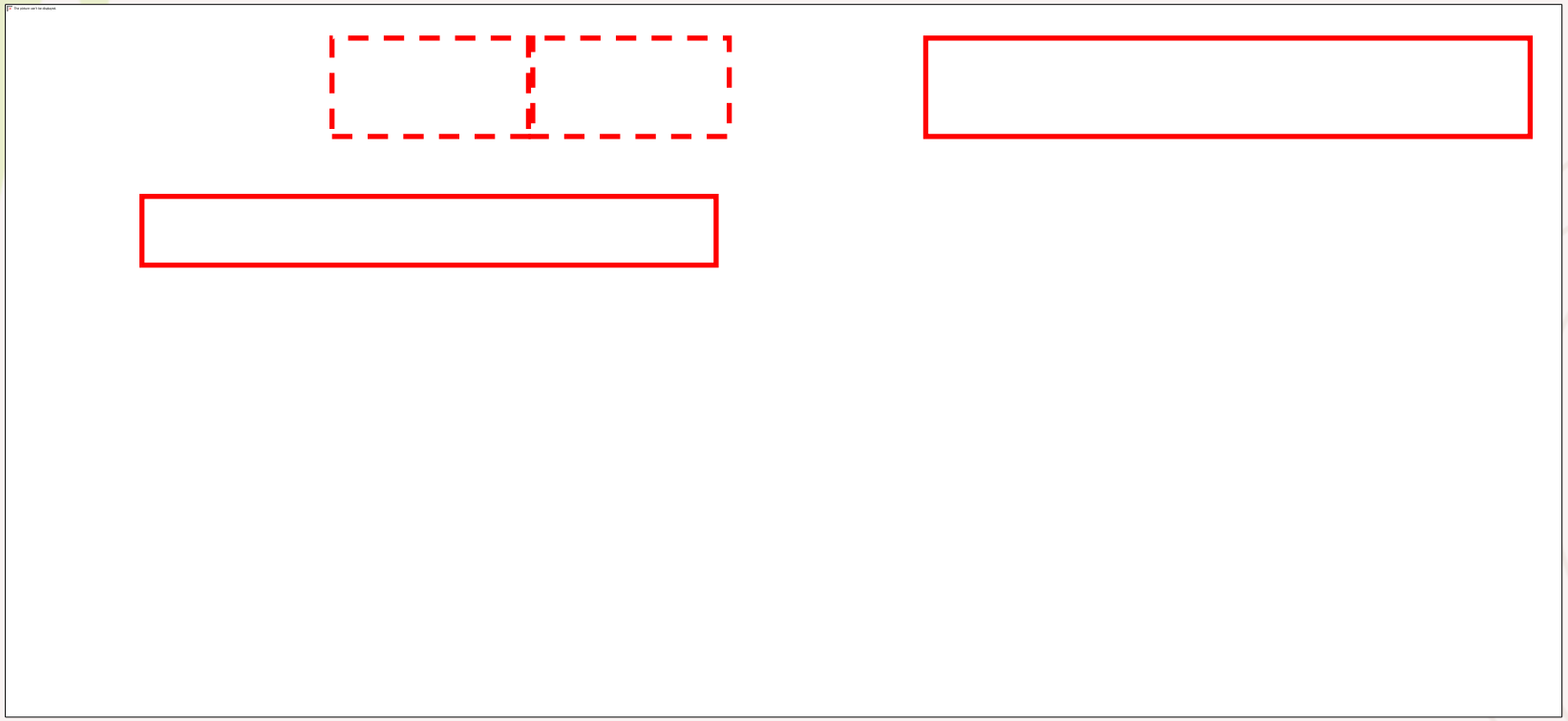
All the attendees

eosc | FAIR-EASE

# FAIR-EASE and the EOSC roadmap

"Innovative and customizable services for EOSC" HORIZON-INFRA-2021-EOSC-01-04

SRIA ***Implementation challenges***



Source: EOSC Future

# SRIA Action Areas in FAIR-EASE

SRIA version 1.1 – November 2022

***Action areas***

**METADATA AND ONTOLOGIES**

GAP/CHALLENGE: Harmonized discovery of multidisciplinary data infrastructures, missing cross-discipline vocabularies/ontologies.

RESULTS: Interdisciplinary Data Discovery and Access Service: (IDDAS) : Harmonised data discovery services of selected data infrastructures in EU and beyond; Discovery support by I-ADOPT smart mapping solutions.

**FAIR METRICS AND CERTIFICATION**

GAP/CHALLENGE: Ensure that the FAIR principles are fully endorsed and implemented in the project's target communities.

RESULTS: Guidelines for the improvement of the FAIRness of research output from the communities involved in the project.

**EOSC INTEROPERABILITY FRAMEWORK**

GAP/CHALLENGE: Harmonisation across domain.

RESULTS: Semantic mappings; Services FAIRness; Improvement of good practices for real involvement and engagement with research communities.

**USER ENVIRONMENTS**

GAP/CHALLENGE: Integration of Virtual labs/Pilots services : distributed thematic and regional community services and resources, cross-domain analysis.

RESULTS: Unified entry point to discover (IDDAS), access and process datasets (Earth Analytic Lab).

**RESOURCE PROVIDER ENVIRONMENTS**

GAP/CHALLENGE: Interoperability and integration of data discovery, access and processing services, Unify Data Access Layer to facilitate data access/download/process.

RESULTS: Data lakes: (i) data discovery services; (ii) catalogue of (direct) data access services; (iii) subsetting services for direct targeted data access.