In-situ Observation and citizen science

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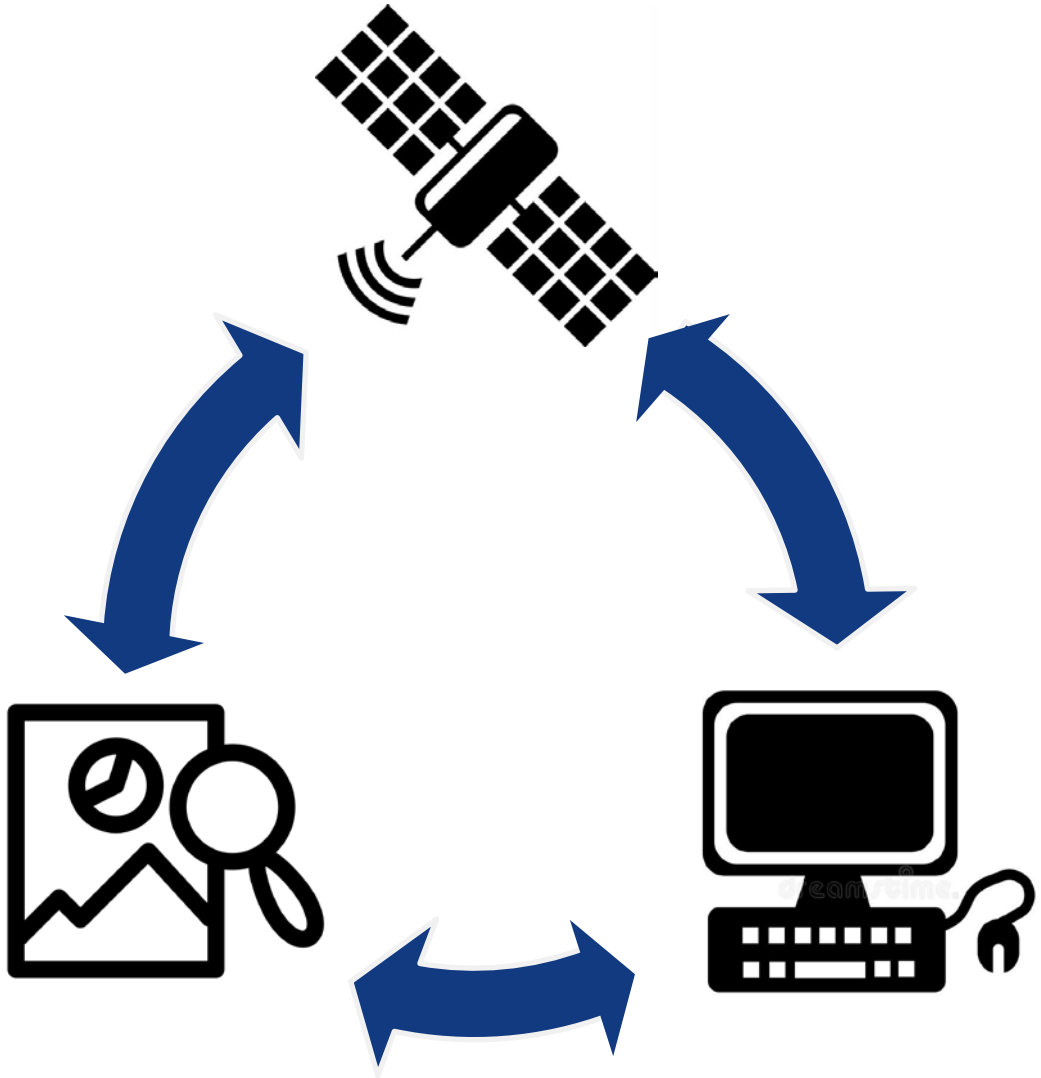
Context

3 components to better study the land-sea interface



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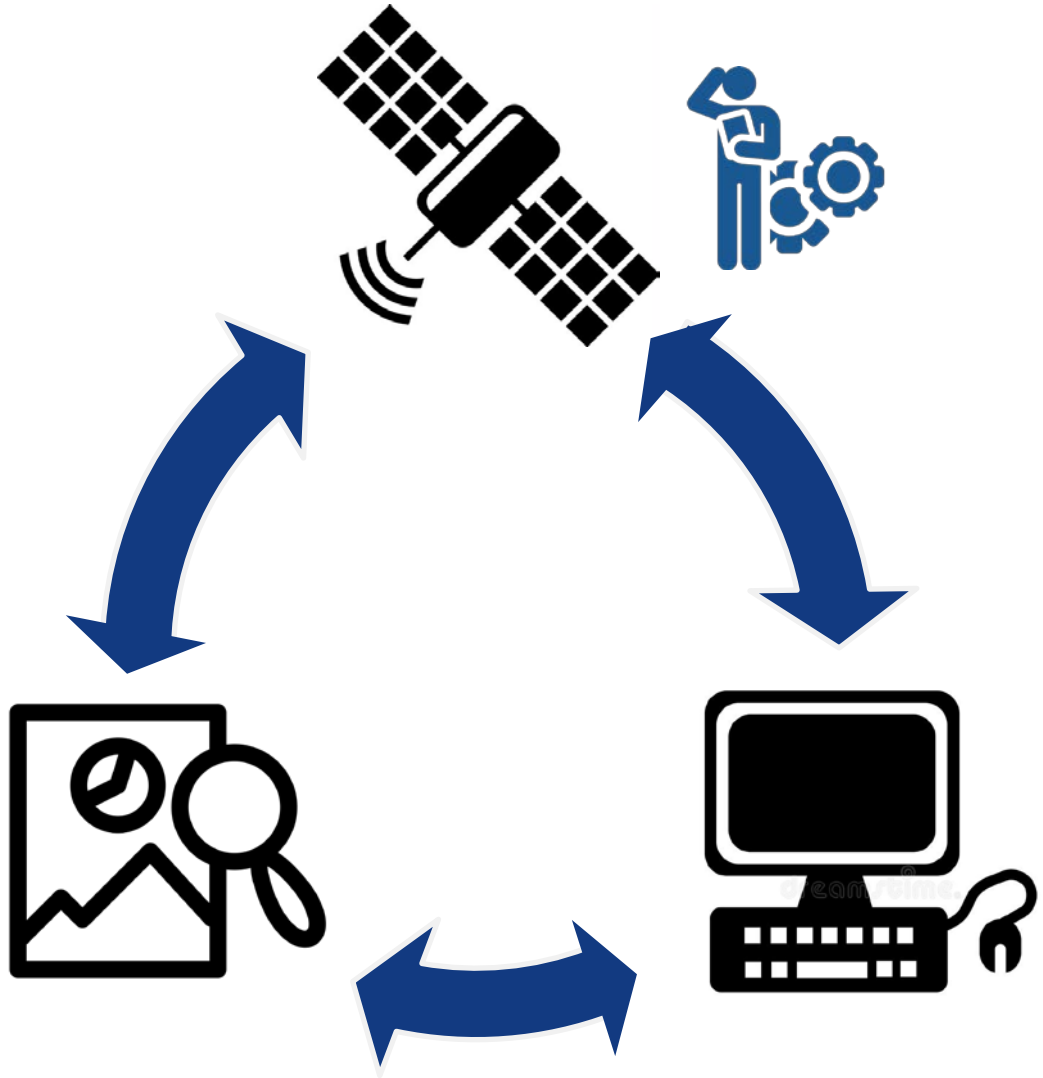

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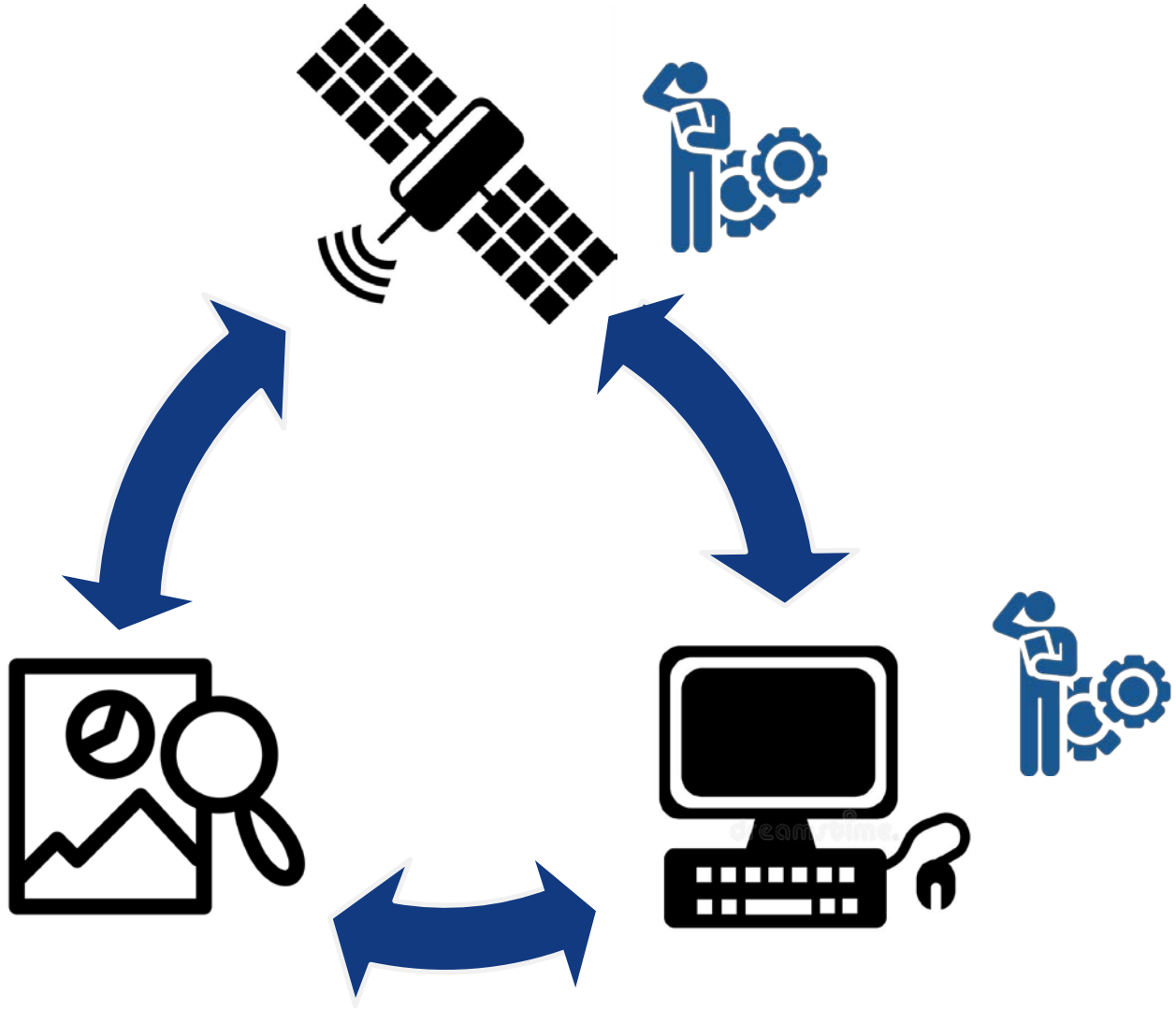

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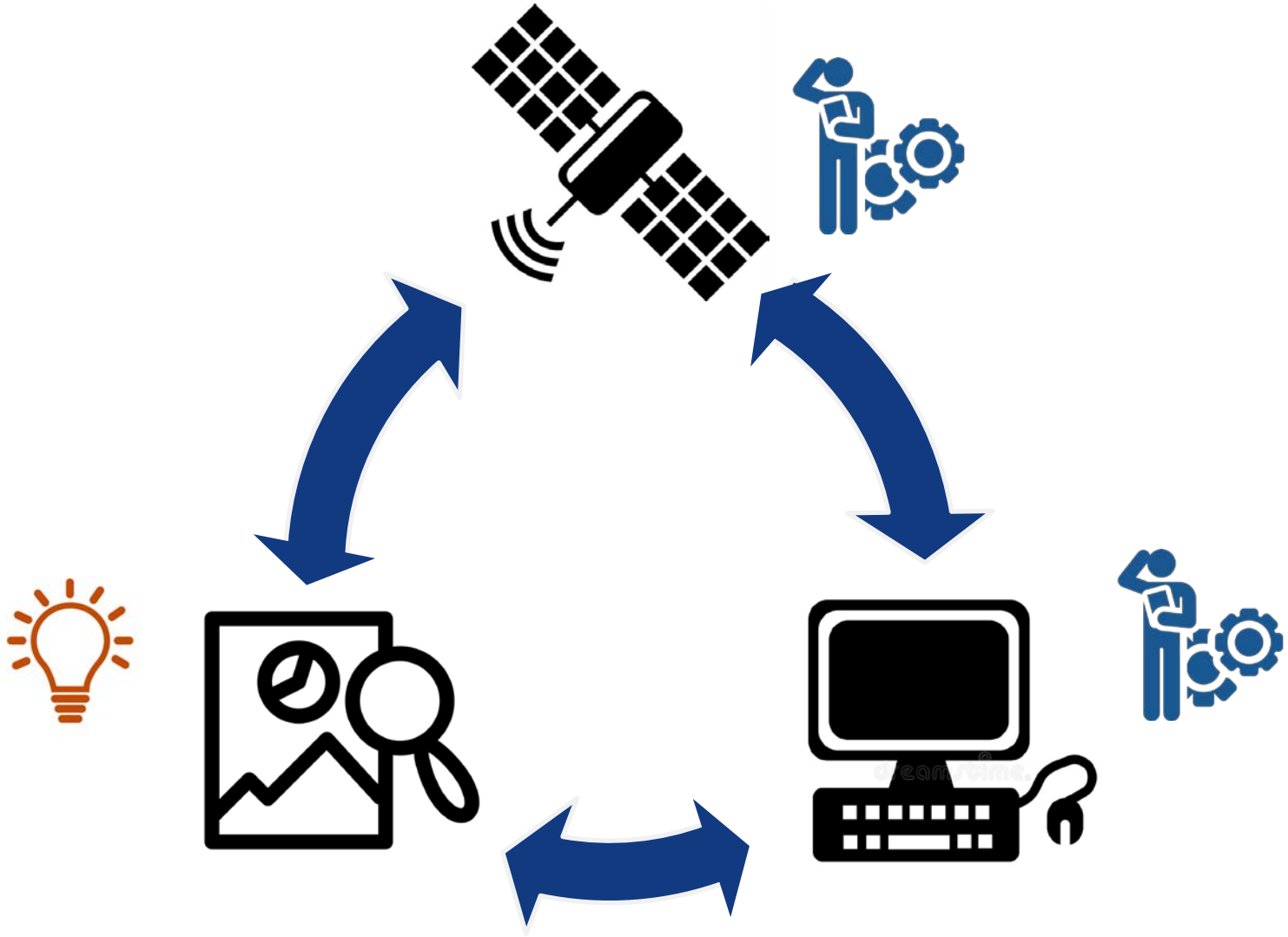

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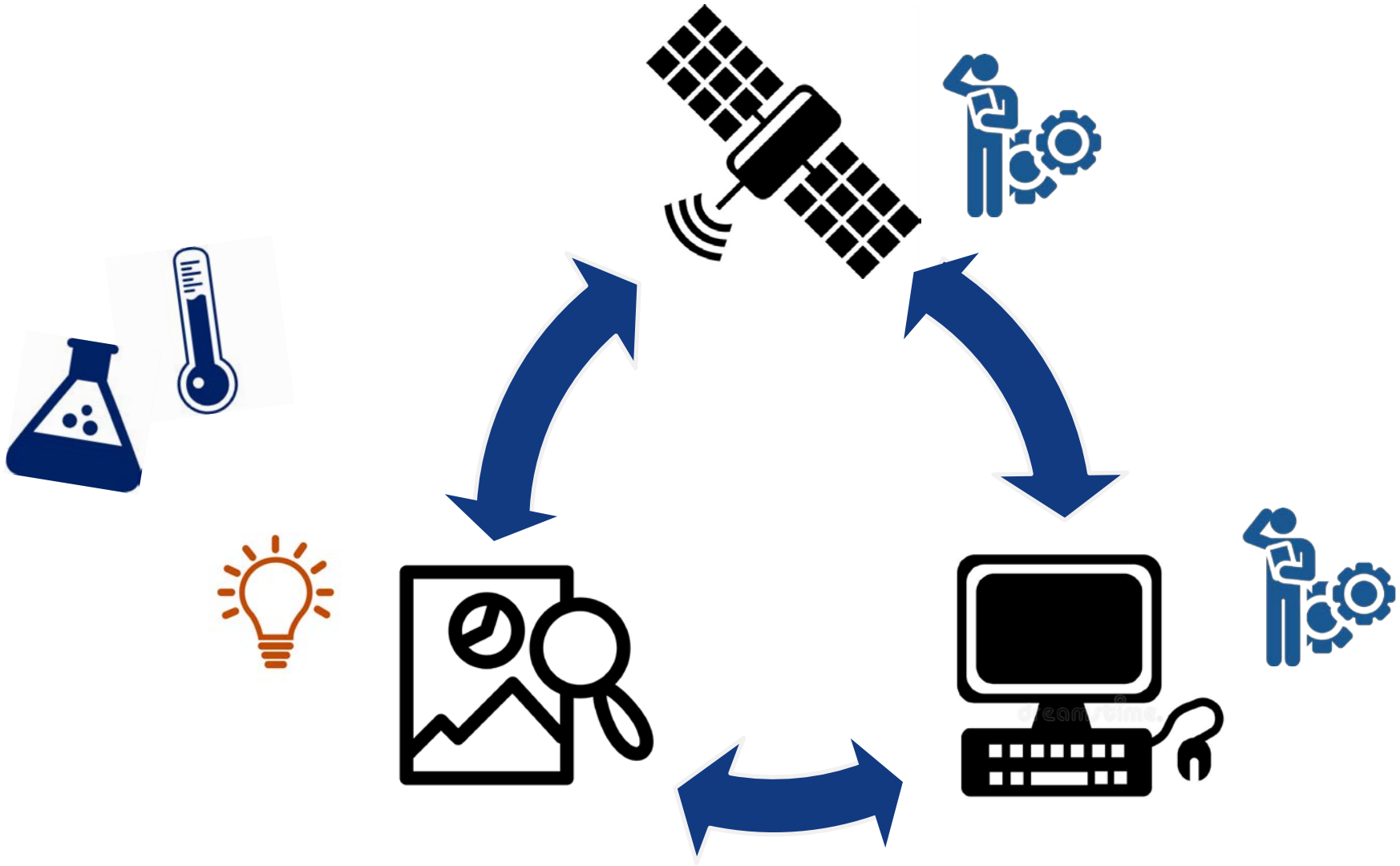

In situ Observation

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Long and rigorous process

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PREPARATION & CALIBRATION

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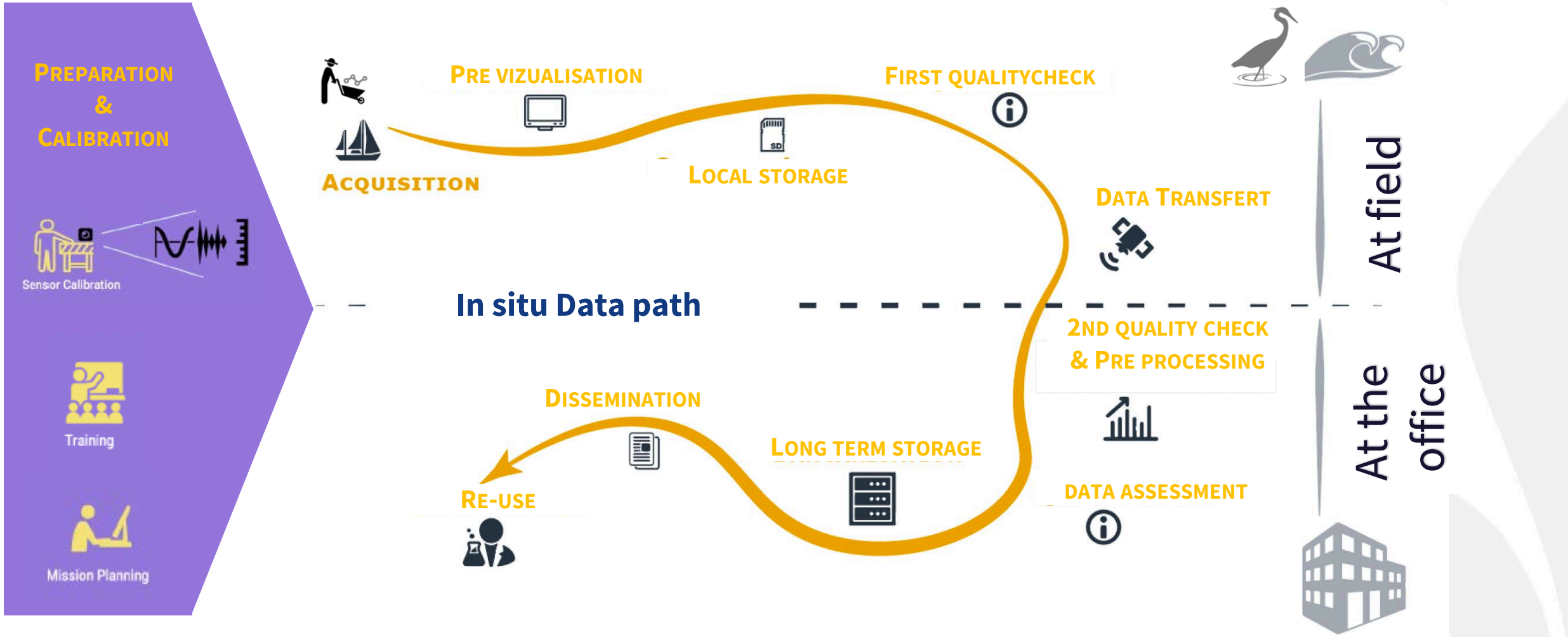

In-situ coastal ocean Observation

A great history

In-situ coastal ocean Observation

A great history

Credits: Fine Art Photographic Library/ Corbis/ Getty Images

Published in 1590 in one of the works of Antwerp cartographer Abraham Ortelius, this map of Iceland and its surroundings illustrates the perception and knowledge of the land-sea continuum at the time.

In-situ coastal ocean Observation

A great history

The **technical and logistical challenges** of making in situ land-sea continuum in situ parameters are legion :

- measurements sometimes have to be taken in **difficult-to-access areas,**
- in a **corrosive liquid,**
- with **variable pressures**
- and in a fluid that is effectively **opaque to electromagnetic radiation.**

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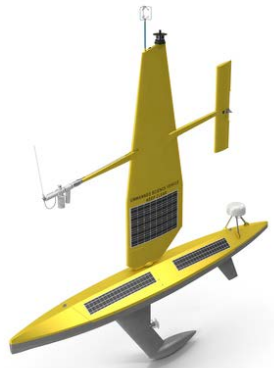
The **other major driver** for progress was the application of advanced technologies to the oceans**—solid state electronics** in the 1960s and 1970s, **miniaturized computing power**, and **satellite communication and navigation** from the 1990s to the present day.

In-situ Observation

A constantly evolving process

The growing demand for ocean observations (particularly in remote areas, in winter and under extreme weather conditions), coupled with the high cost of operating research vessels, has stimulated explosive growth in **autonomous ocean observation platforms.**
Modifications and innovative use of existing observing platforms are beginning to fill this data gap.



In-situ Observation

A constantly evolving process

Sensors and Platforms evolve, but so do **techniques and methodologies**:

The **potential of metabarcoding** to study marine systems is just one example of the important contributions that highlight the advances of recent years.
Traditional study methods can be costly and time-consuming, and the potential effectiveness of eDNA techniques should **change the way we conduct biodiversity research**, answering questions ranging from eDNA ecology to food web dynamics and biogeographical factors.

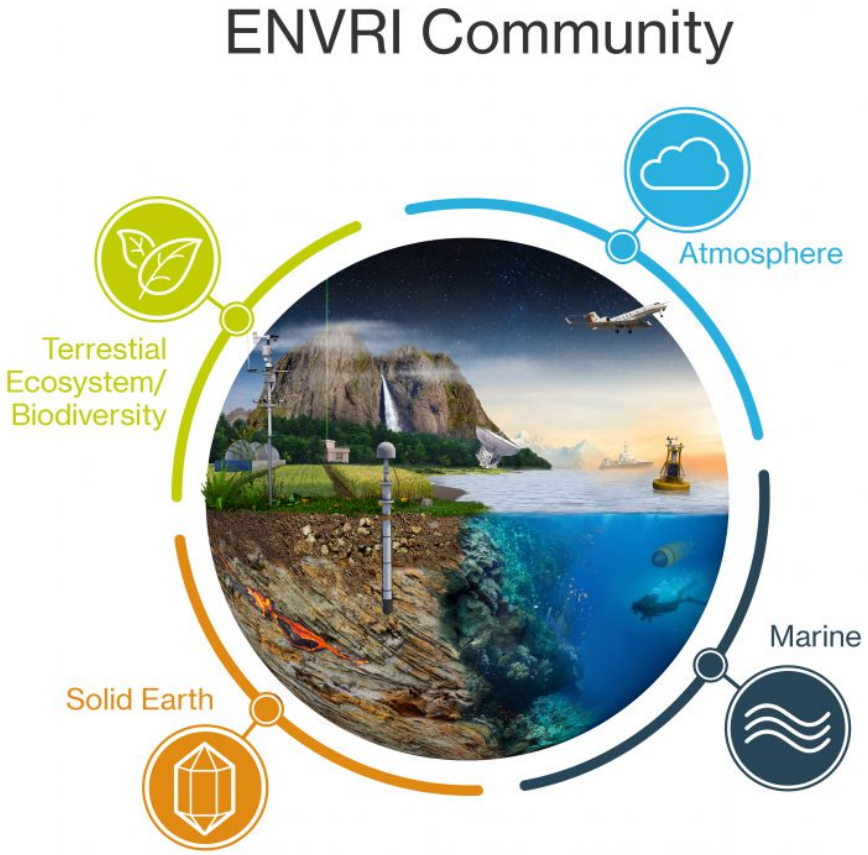
In situ Ocean Observing structuration

In-situ Observation

Research-driven structuration

In-situ Observation

Research-driven structuration



In-situ Observation

Research-driven structuration

ICOS | Integrated Carbon Observation System

LOT LAND SEA

In-situ Observation

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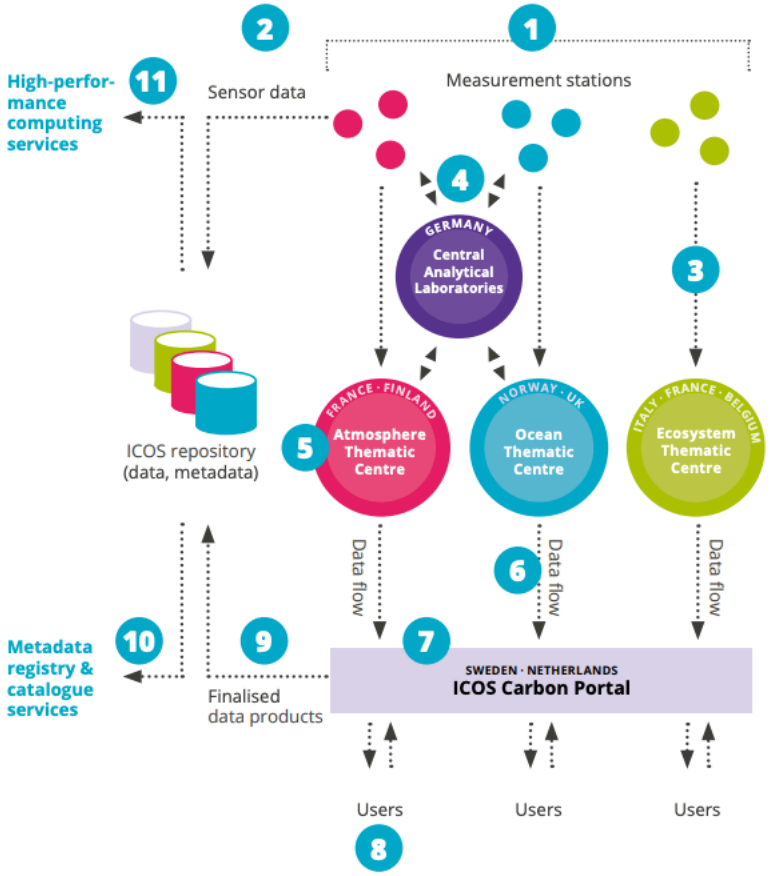
Figure 4. Schematic diagram of the ICOS data-production process.



Data is generated and collected.

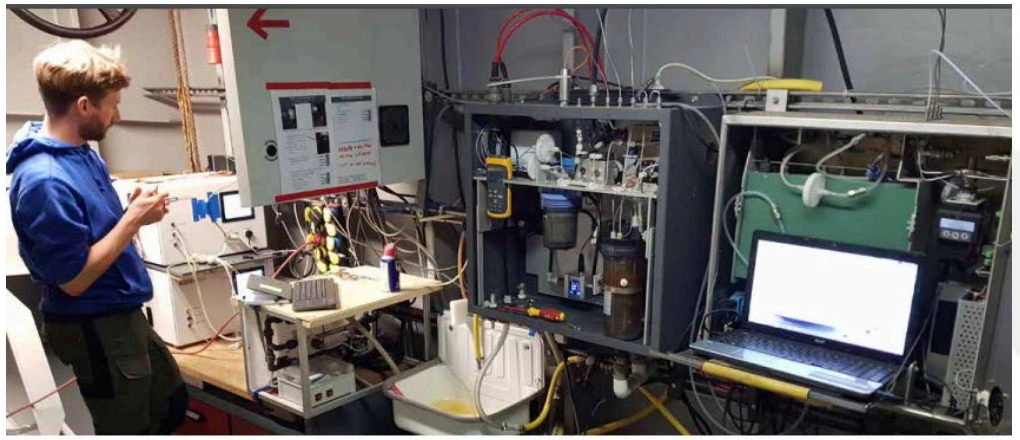
Data is curated and processed: e.g. metadata such as originating experiment, persistent identifiers and quality assurance annotations.

Data is published, and services for transformation, collation and analysis are provided.

Researchers use the data, potentially producing new research data.

OCEAN THEMATIC CENTRE

- Leadership, coordination, network design and stakeholder liaison
- Labelling
- Data availability and quality
- Training
- New technology and platforms



In-situ Observation

Research-driven structuration

DANUBIUS-RI

International Centre for Advanced Studies on River-Sea Systems

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Research-driven structuration

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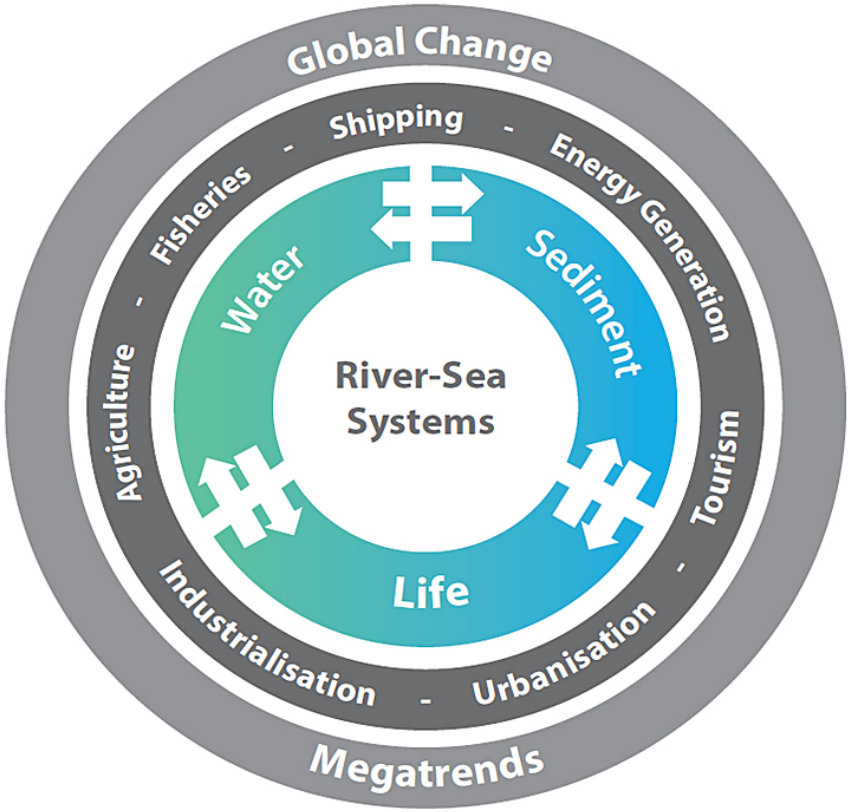

DANUBIUS-RI offers :

- **State-of-the-art and fit-for-purpose facilities** of river to coastal sea observation systems;
- **Development & implementation of interoperable and harmonised methods**, tools and models, to achieve comparability across the freshwater-seawater continuum;
- **Smart observation and analytical tech**nologies developed jointly with SMEs;
- Education and **training programmes** for scientists;
- **Data portal** to integrate existing data and knowledge across sectors and disciplines, supplemented by new data and syntheses;
- **Engagement with public authorities and policy makers** through assessment, evaluation and measures to improve the environmental status of River-Sea Systems;
- **And more !**

In-situ Observation

Research-driven structuration

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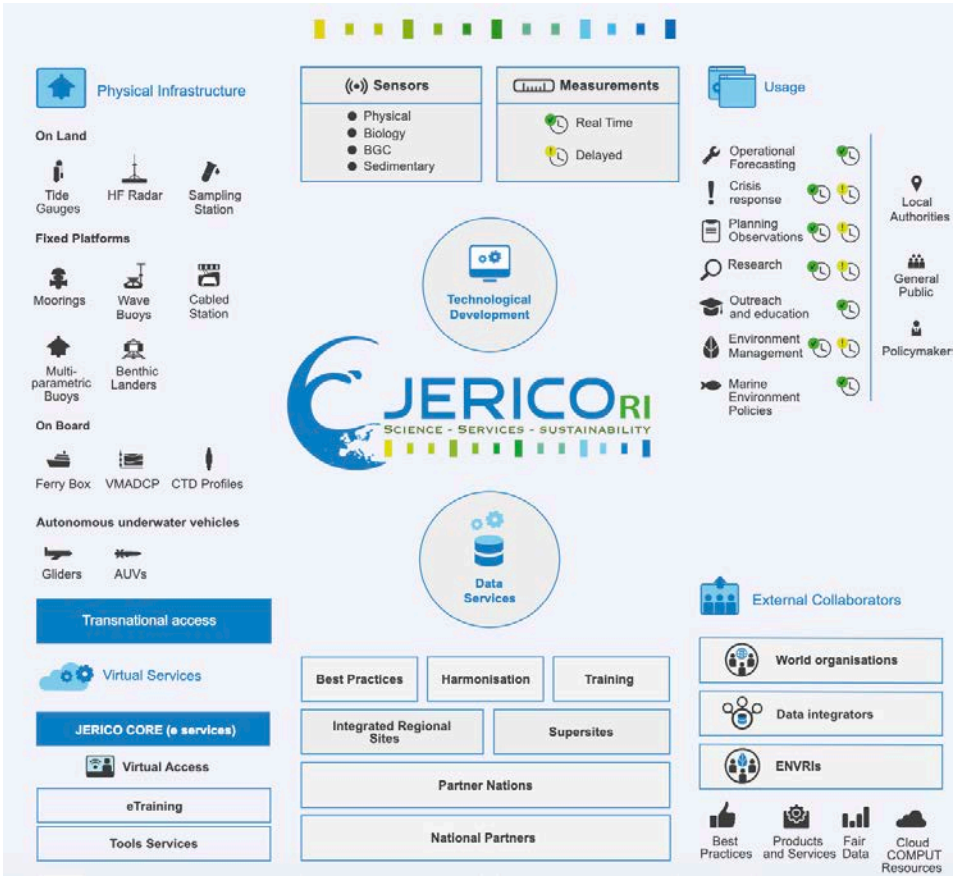
JERICO RESEARCH INFRASTRUCTURE

LOT LAND SEA



JERICO Services :

- JERICO-RI provides a **sustainable framework of facilities, expertise and data** to support growth, development and innovation in the blue industry. The JERICO-RI aims at forming partnerships with industries contributing to **marine observations by developing joint activities and promoting mutual benefit.**
- JERICO-RI **supports the development of downstream services** by SMEs through free access to high-quality, continuous, multidisciplinary, marine environmental data.
- JERICO-RI **facilitates technological innovations by providing access to a long-term pan European coastal infrastructure** for proof of concept, verification and demonstration of emerging technologies in a variety of easy-accessible natural environments and with the support of a **network of experts.**
- And more !

Towards Sustained *In-situ* Observation

The next challenge

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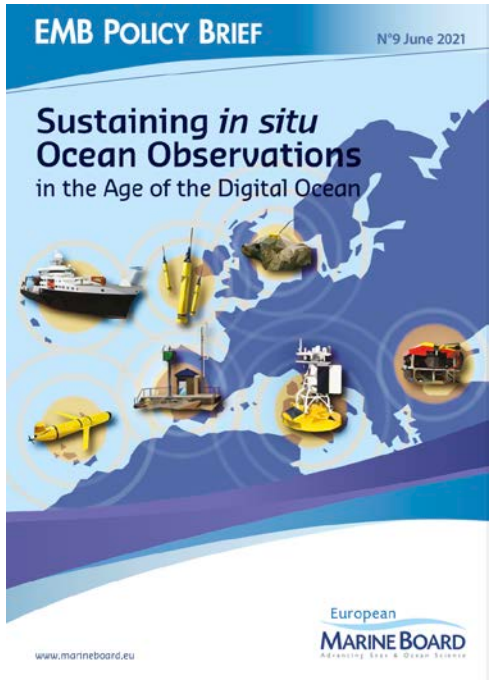

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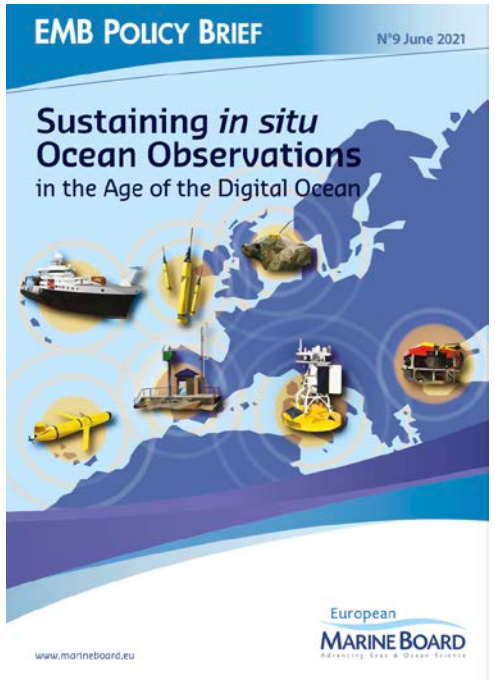

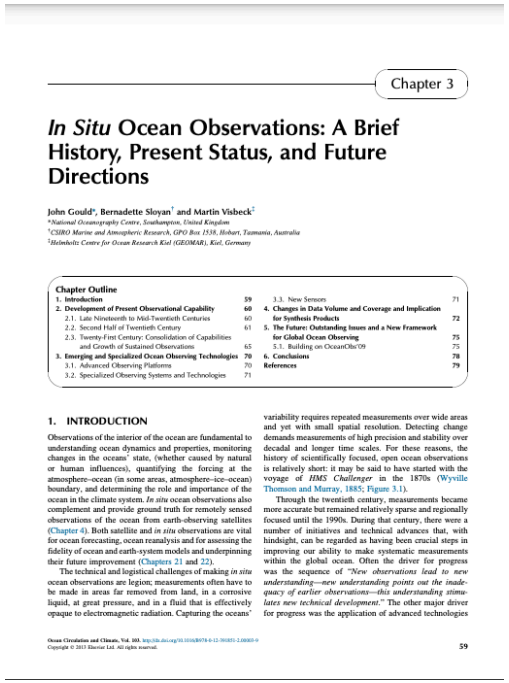

Chapter 3

In Situ Ocean Observations: A Brief History, Present Status, and Future Directions

John Gould[a], Bernadette Sloyan[1] and Martin Visbeck[2]
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[1]*CSIRO Marine and Atmospheric Research, GPO Box 1538, Hobart, Tasmania, Australia*
[2]*Helmholtz Centre for Ocean Research Kiel (GEOMAR), Kiel, Germany*

Chapter Outline

1. INTRODUCTION

Observations of the interior of the ocean are fundamental to understanding ocean dynamics and properties, monitoring changes in the oceans' state, (whether caused by natural or human influences), quantifying the forcing at the atmosphere–ocean (in some areas, atmosphere–ice–ocean) boundary, and determining the role and importance of the ocean in the climate system. *In situ* ocean observations also complement and provide ground truth for remotely sensed observations of the ocean from earth-observing satellites (Chapter 4). Both satellite and *in situ* observations are vital for ocean forecasting, ocean reanalysis and for assessing the fidelity of ocean and earth-system models and underpinning their future improvement (Chapters 21 and 22).

The technical and logistical challenges of making *in situ* ocean observations are legion; measurements often have to be made in areas far removed from land, in a corrosive liquid, at great pressure, and in a fluid that is effectively opaque to electromagnetic radiation. Capturing the oceans' variability requires repeated measurements over wide areas and yet with small spatial resolution. Detecting change demands measurements of high precision and stability over decadal and longer time scales. For these reasons, the history of scientifically focused, open ocean observations is relatively short: it may be said to have started with the voyage of *HMS Challenger* in the 1870s (Wyville Thomson and Murray, 1885; Figure 3.1).

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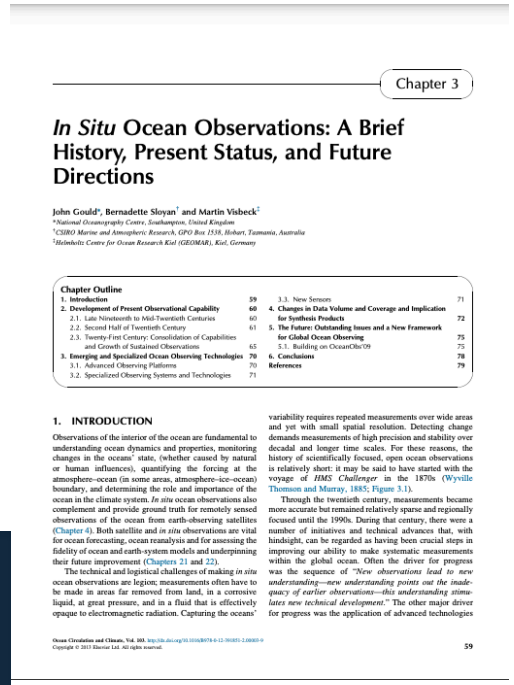

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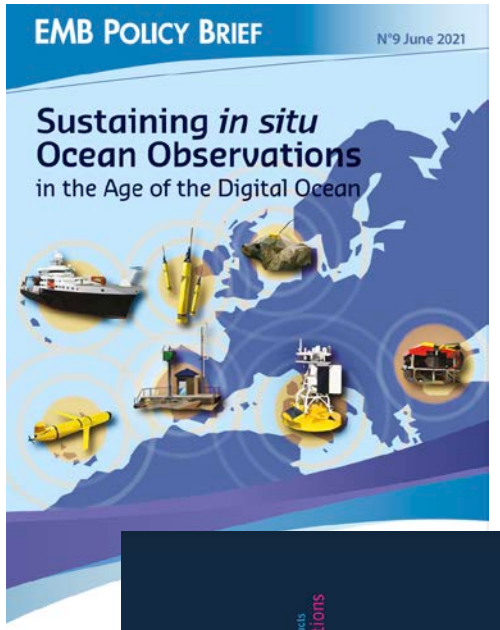

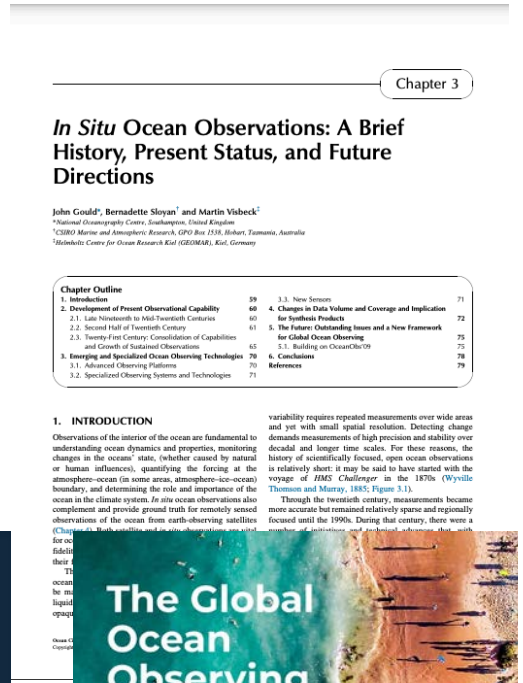
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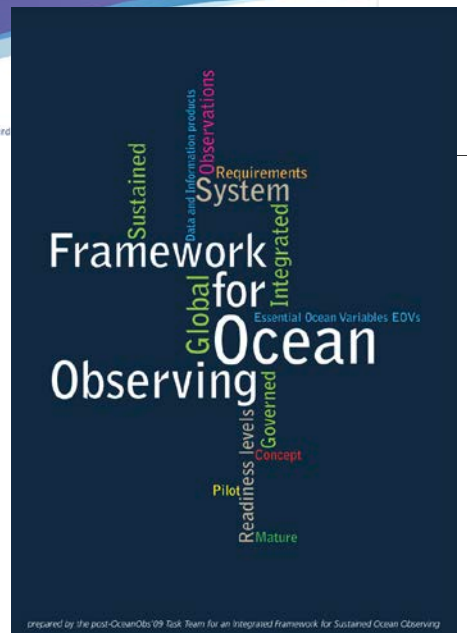

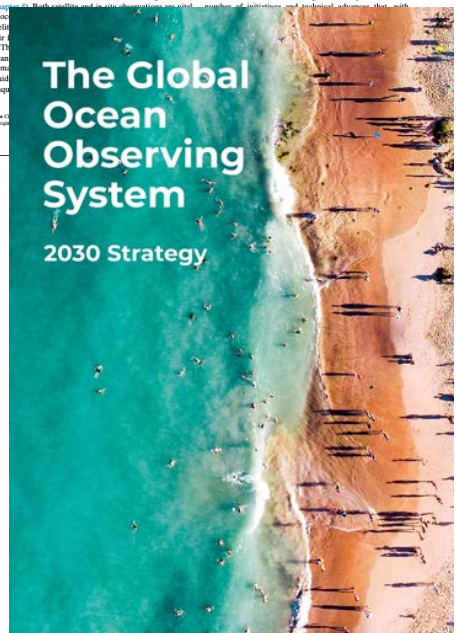

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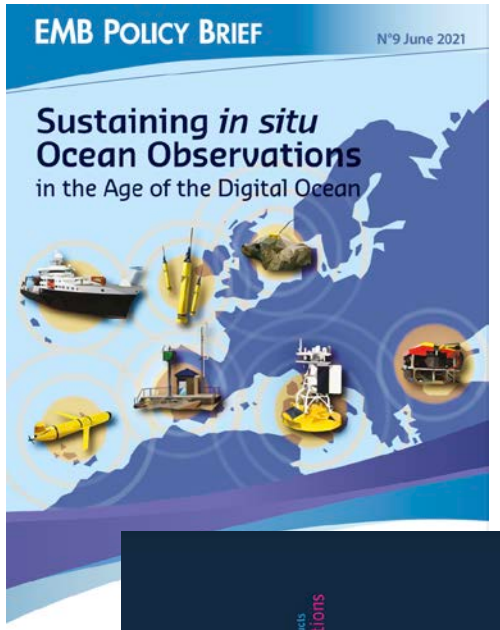

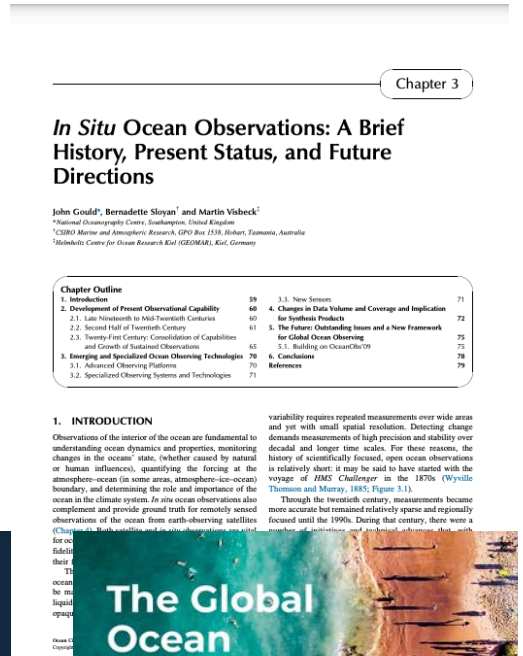
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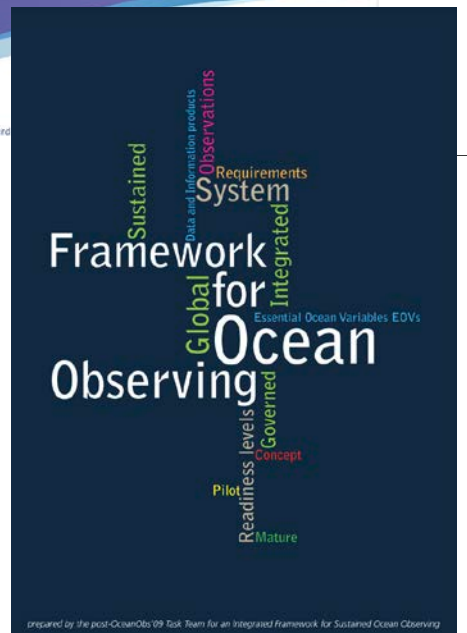

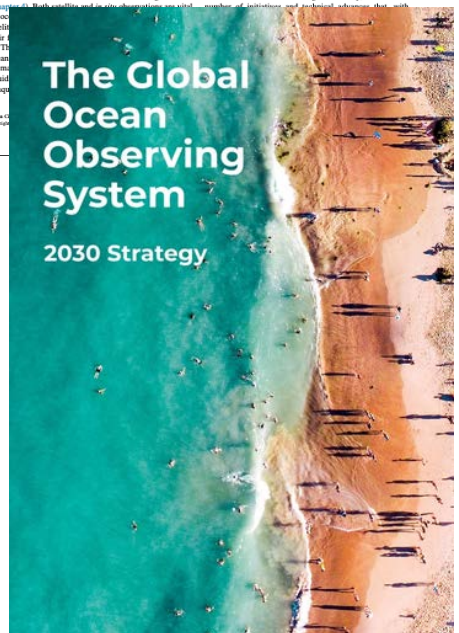

Box 1: What are Sustained *in situ* Ocean Observations and the Ocean Observation Value Chain?

Sustained *in situ* Ocean observations are all Ocean, seas or coastal observations, which are made primarily for public good (i.e. monitoring), and/or for research of public interest. They complement remote sensing observations (e.g. from satellites) and either persist over extended durations (e.g. decades) or have no planned end-date. Sustained *in situ* Ocean observations target phenomena which have large space-time scales (e.g. the impact of ice melt water from Polar regions), or which need long time-series to detect signals and trends (e.g. the impact of climate change on species distributions). They are continuous in order to detect extremes (e.g. marine heatwaves) or episodic events (e.g. volcanic eruptions) and thus generate long data series and/or repeated observations, used to reassess system state. Ocean observations form the basis of the value chain towards public benefit (Fig. 1). They provide the data used in models and analyses to create information, which is turned into knowledge by resource managers and policy makers and used to enact change as well as advance scientific knowledge and understanding. The value of observations is increased by each step in this chain and there is continuous feedback between all these levels: e.g. new policies will create new observation requirements and new model predictions will show where different observations are needed.

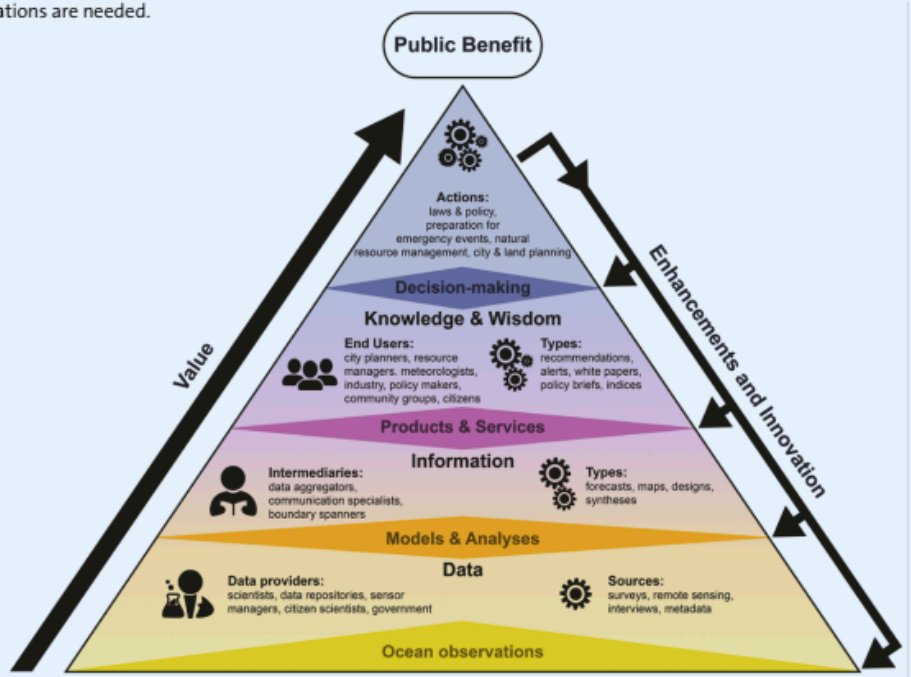

Fig. 1. The Ocean observation value chain[4].

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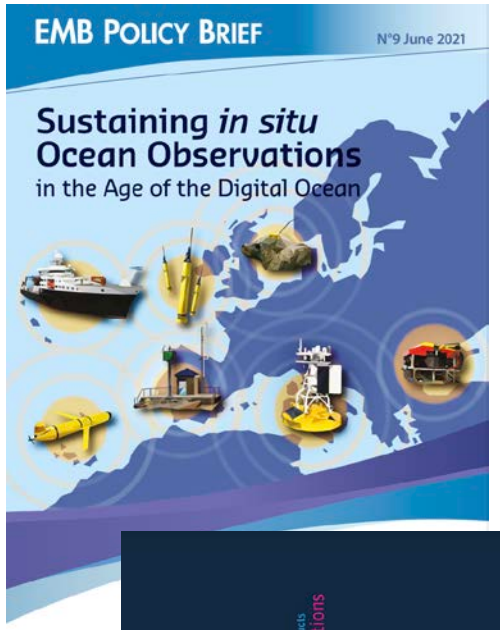

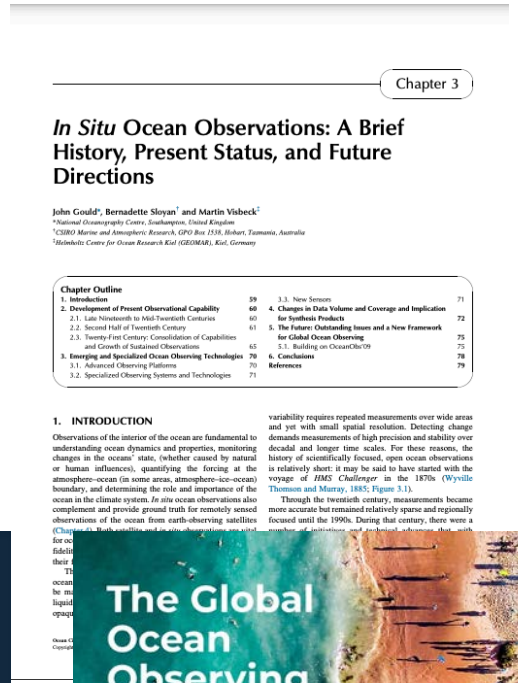
Chapter 3

In Situ Ocean Observations: A Brief History, Present Status, and Future Directions

John Gould[a], Bernadette Sloyan[b] and Martin Visbeck[c]

[a]National Oceanography Centre, Southampton, United Kingdom
[b]CSIRO Marine and Atmospheric Research, GPO Box 1538, Hobart, Tasmania, Australia
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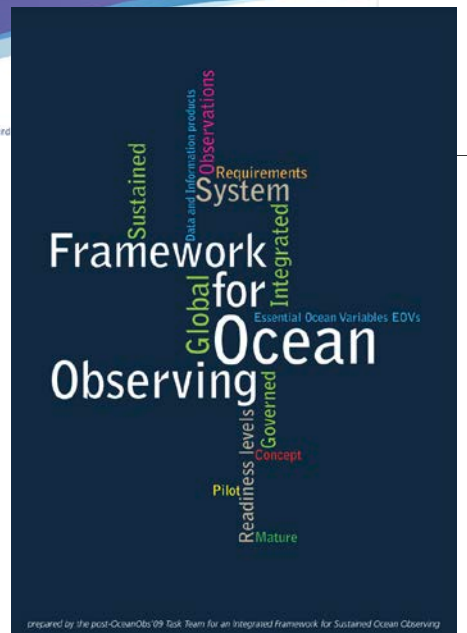

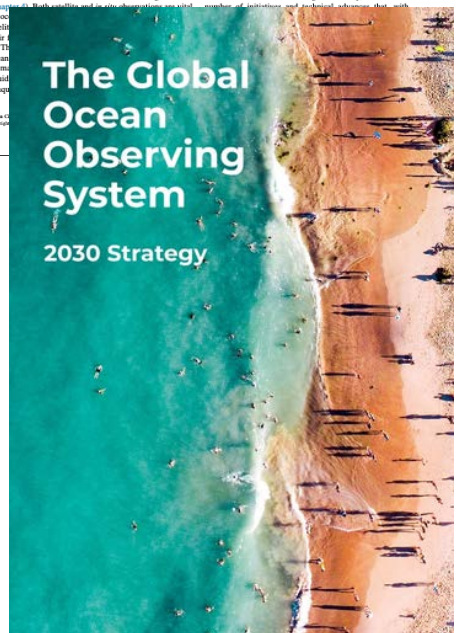

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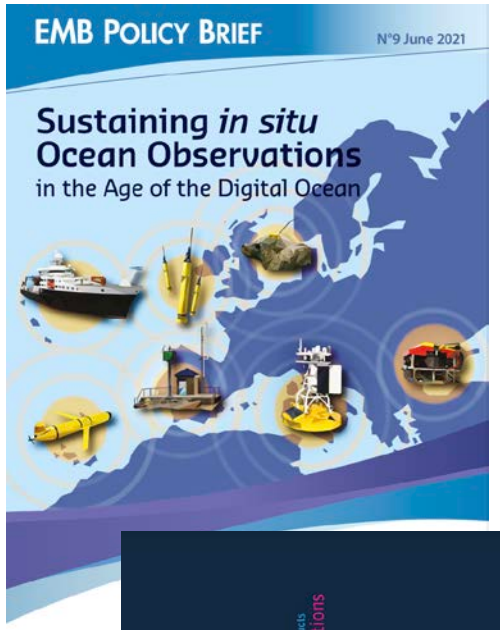
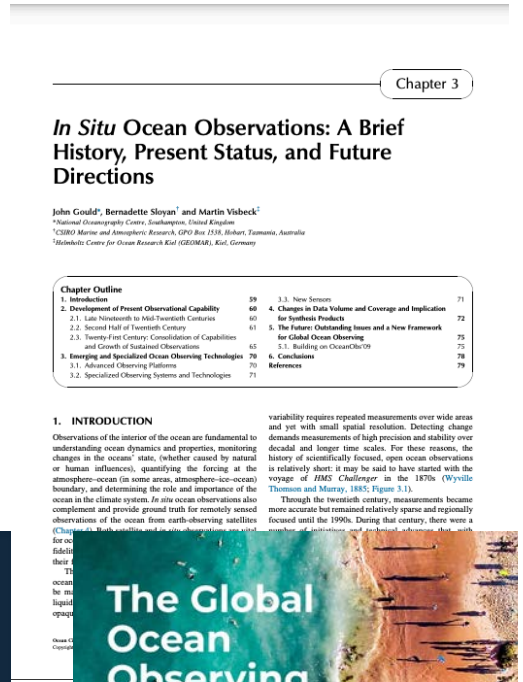
The next challenge

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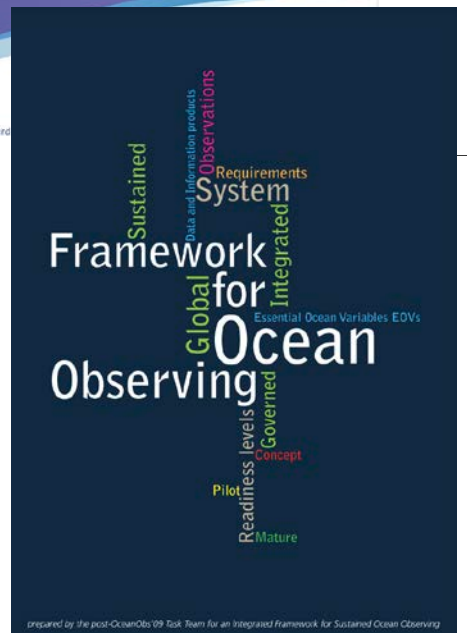

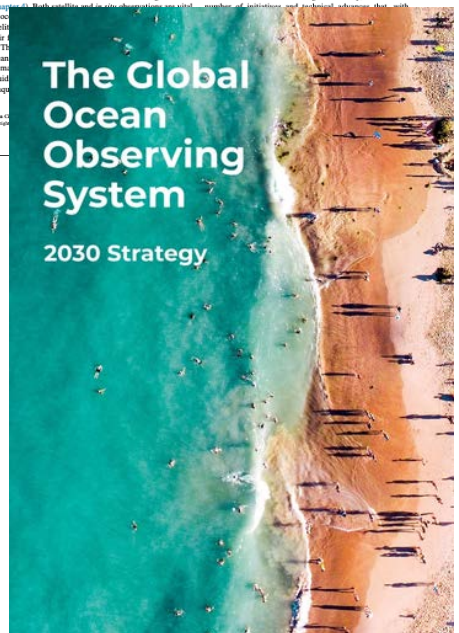

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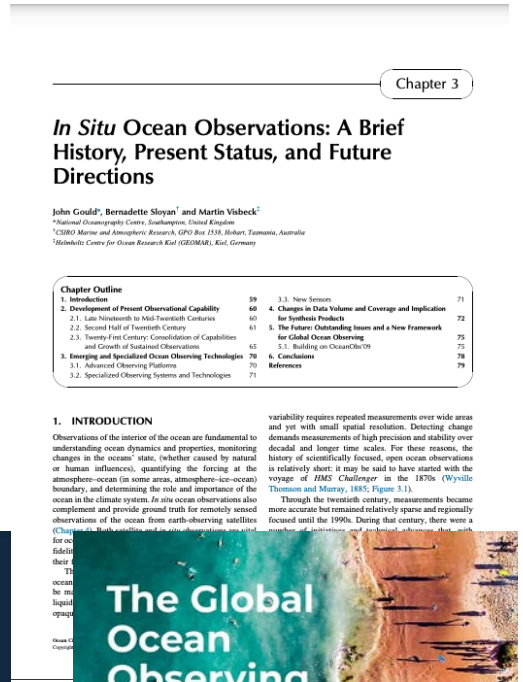
Towards Sustained *In-situ* Observation

The next challenge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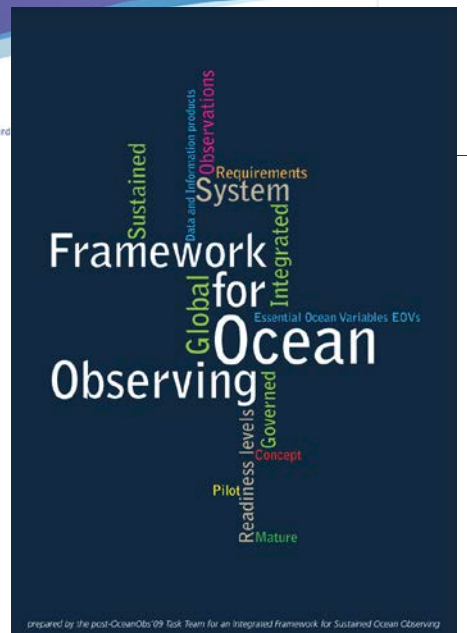

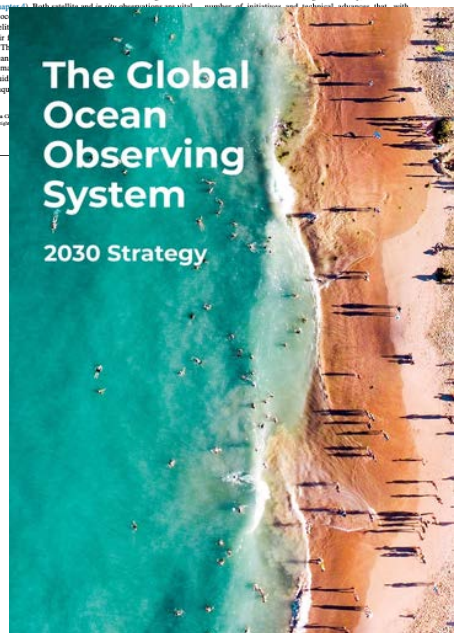

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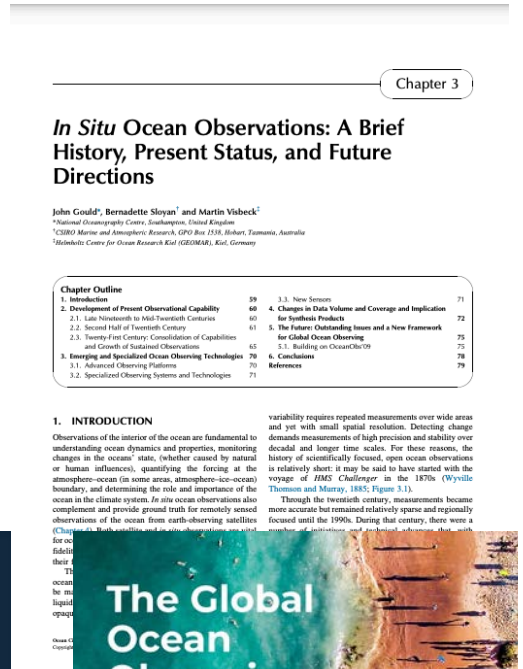
While these constraints may hinder progress, **the dedication, persistence, and innovative nature our science community** that has already made such remarkable progress might be expected to **overcome such obstacles.**

Towards Sustained *In-situ* Observation

The next challenge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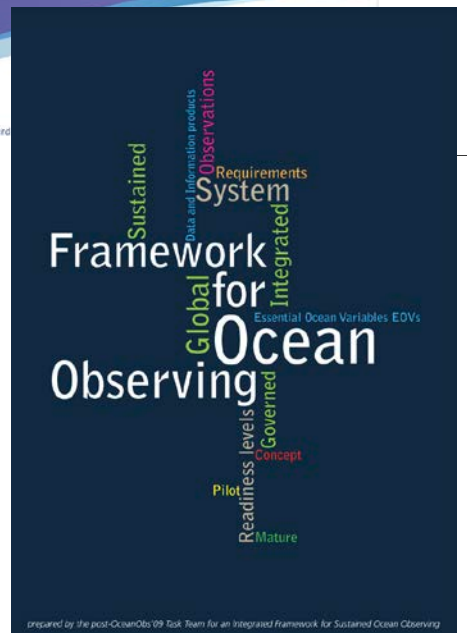

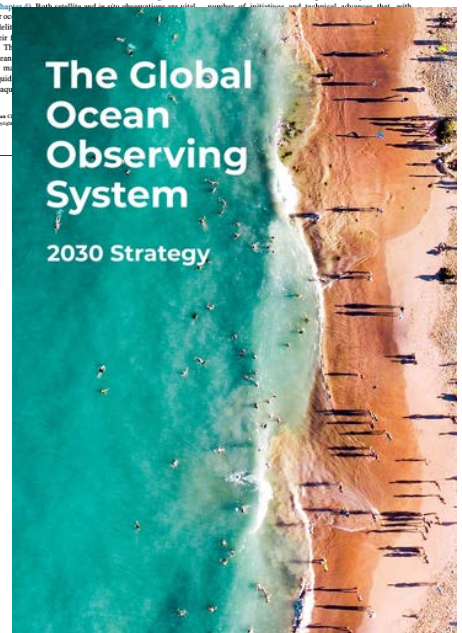

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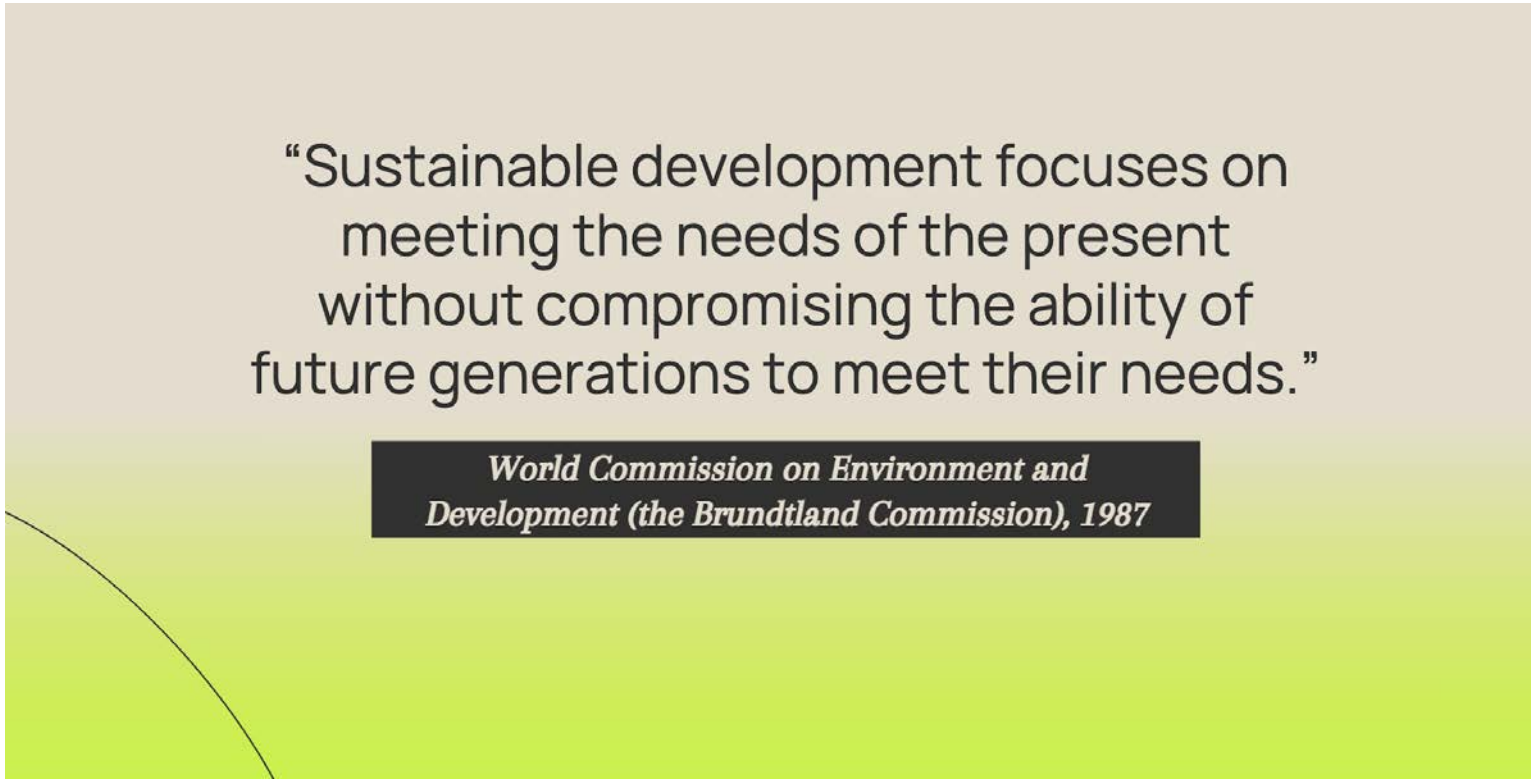
The highest priority for the coming decade must be **to sustain the present ocean observing system**, while **improving its coverage and data quality.**

In situ Ocean Observation Sustainability

Towards Sustained *In-situ* Observation

& Citizen science



Towards Sustained *In-situ* Observation

& Citizen science

Economical sustainability

"Sustainable development focuses on meeting the needs of the present without compromising the ability of future generations to meet their needs."

World Commission on Environment and Development (the Brundtland Commission), 1987

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Economical sustainability

Environmental sustainability

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"Sustainable development focuses on meeting the needs of the present without compromising the ability of future generations to meet their needs."

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Citizen science may be the inspiration

Towards Sustained *In-situ* Observation

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Definition of “**Citizen Science Initiatives**” for purposes of the presentation:

Towards Sustained *In-situ* Observation

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Citizen science, broadly defined as public participation in scientific research and knowledge production. Despite joint attempts by the major North and European Citizen Science associations to standardize the field, substantial differences persist. To shed light on these differences, Muki Haklay proposes to distinguish four levels of participation in citizen science:

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Participation level	Associated term	Role of citizens
Level 1	*Crowdsourcing*	*Citizens contribute as data sensors, despite not being formally trained experts.*
Level 2	*Volunteer Thinking,*	*Citizens contribute to data interpretation*
Level 3	*Participatory science*	*Citizens help define the problem and collect data*
Level 4	*Full cooperation*	*Research is collaborative in all its phases (problem definition, data collection, analysis)*

Towards Sustained *In-situ* Observation

& Citizen science

Citizen science may be the inspiration :

Who has the right to document the environment?

Towards Sustained *In-situ* Observation

& Citizen science

Citizen science may be the inspiration :

Who has the right to document the environment?

The professional scientist?

The expert environment manager?

The enlightened amateur?

The citizen?

In-situ Observation structuration .. Next challenges ?

More and more data ?

Citizen science may be the inspiration :

Who has the right to document the environment?

French perspective :

- 1794: "The republic has no need of scientists".
- From 1850: Science became more professional
- From 2000: Increasing involvement of citizens and non-professionals

Towards Sustained *In-situ* Observation

& Citizen science

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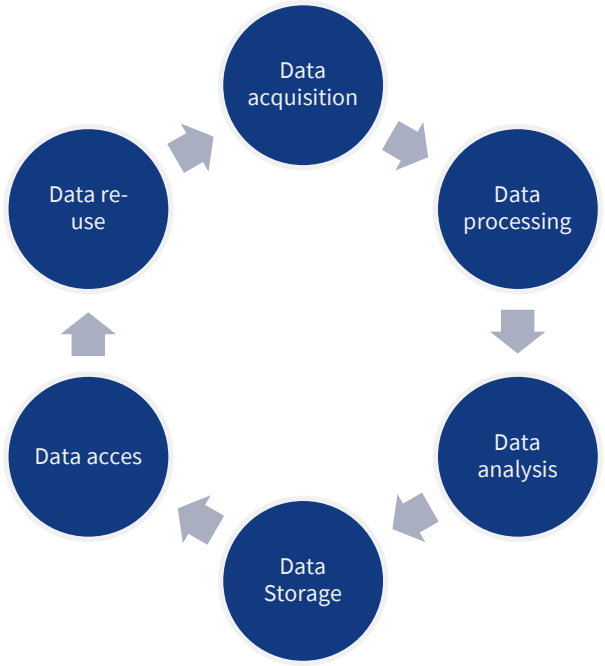
Ocean As Common

Towards Sustained *In-situ* Observation

& Citizen science - opportunities

Observation activity:

Observation activity relies on "Data Life Cycle".



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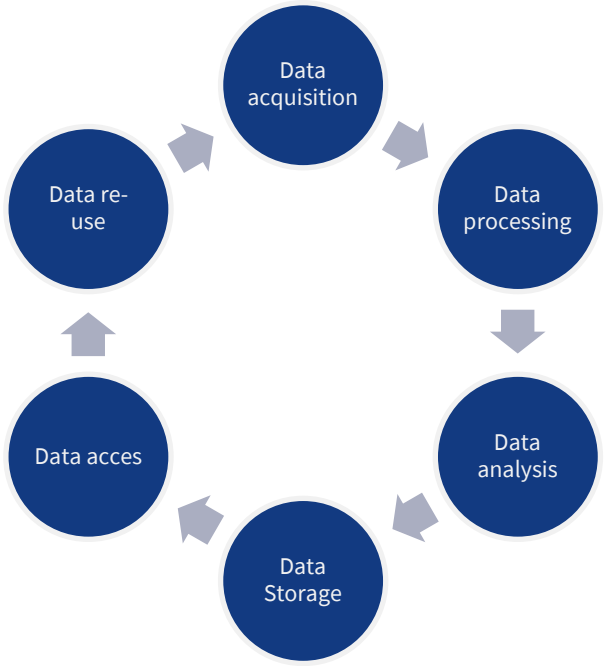

Citizen science
Can be everywhere !

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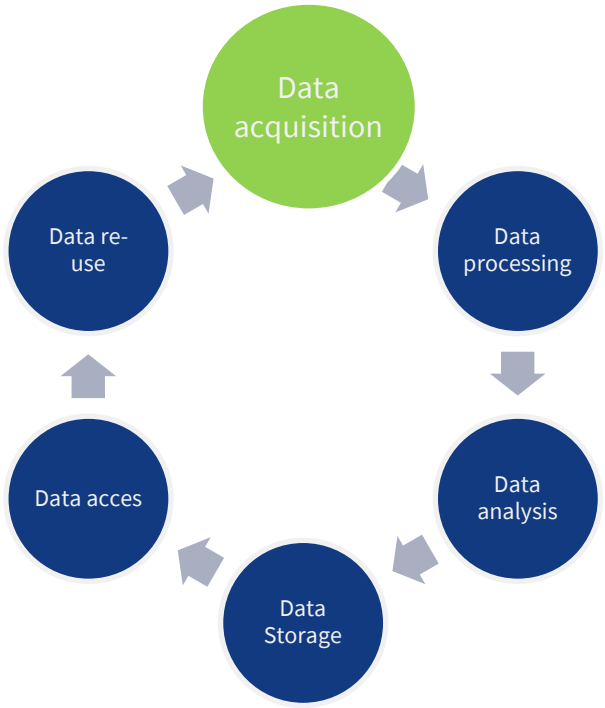

Simple, robust protocols...
or even co-designed

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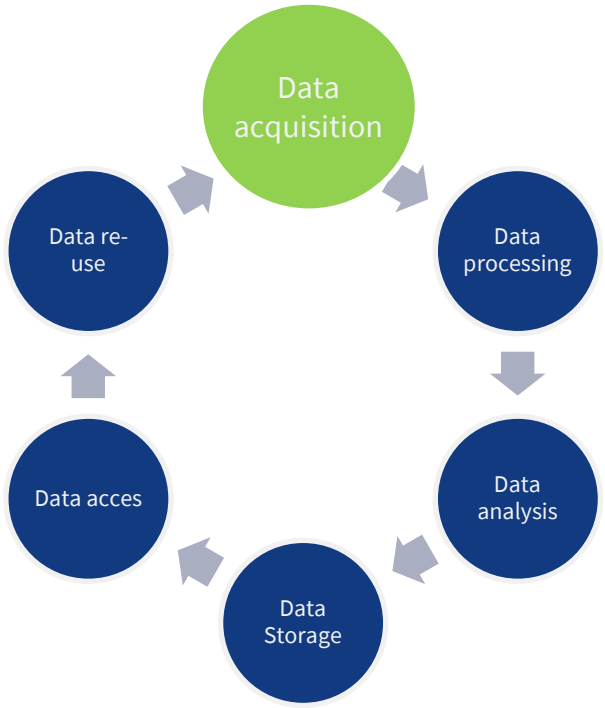

Simple, robust protocols...
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Collaboration based on trust
Clear identification of roles
Concept of commitment/investment clarified

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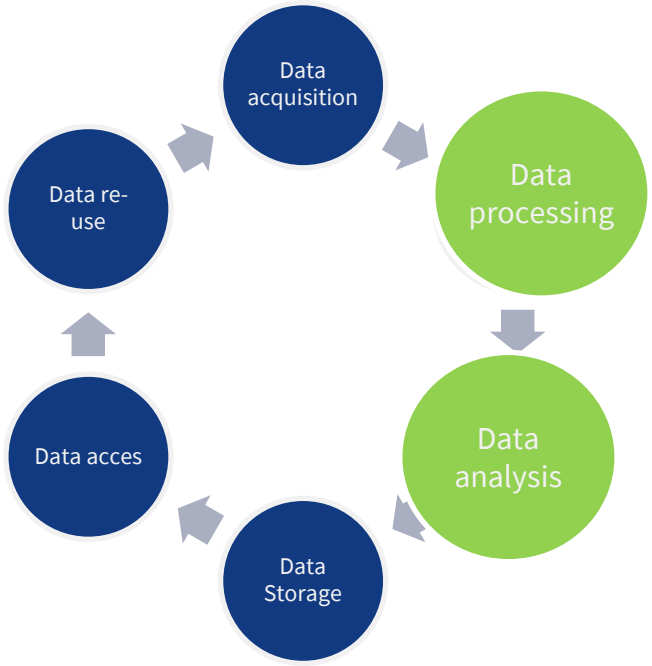

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Data sciences offers real opportunities to tackle what may appear as a Citizen Science bottleneck : machine learning, blockchain, etc..

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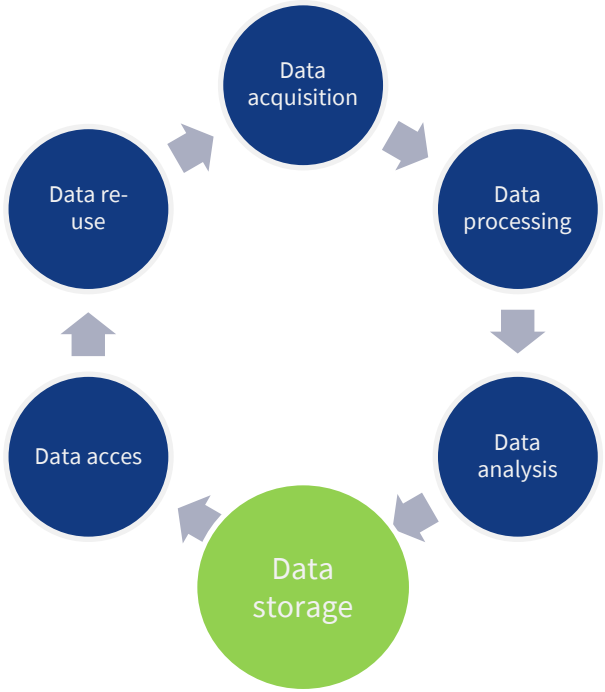

Citizen science initiatives can help us develop use-oriented data platform

Observation activity:

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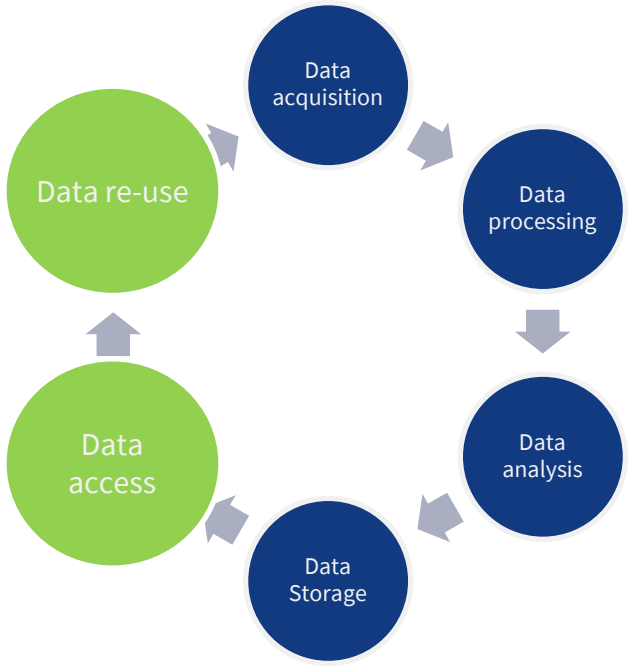
Citizen science initiatives can help :

- Involving other actors from the start (Collaborative Research)
- Developing an open data policy
- Promoting training to and through observation



Towards Sustained *In-situ* Observation

& Citizen science - Challenges

The value of being assisted d by intermediate key players

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& Citizen science - Challenges

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Some Intermediate key players :

NGO, Citizen associations, Outreach experts, project managers, specialized consultants, Fablabs, nature parks, etc.

Take home message :

Do not run *In situ* Observation by yourself..

Let’s observe together!

Visit landsealot.eu

Be part of the conversation

Funded by
the European Union

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