The Research Object Paradigm to manage the scientific Life Cycle within the marine domain - The EVER-EST Solution

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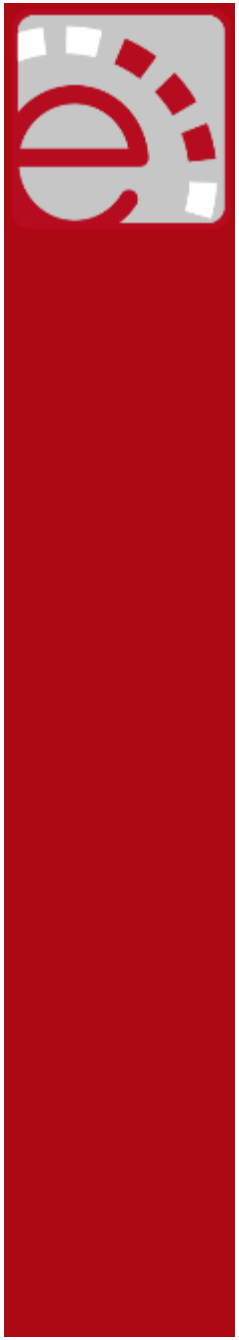
Outline

- The Research Life Cycle Management within the Earth Science Community
- The relevance of Research Data life cycle results standardization and interoperability (Data ROs, Workflows ROs)
- The EVER-EST Solution - the adoption of the RO paragim
- Sea monitoring USE Cases within the Marine Strategy Framework Directive (MSFD)
- Conclusions

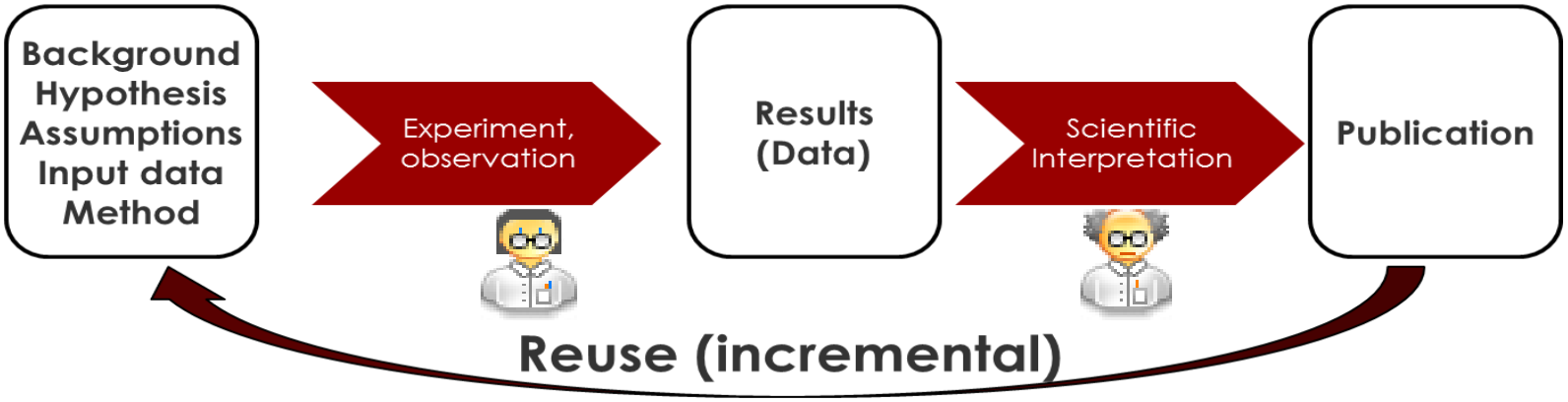
The Research Life cycle management

From data collection and re-use to scientific publication

1)ISI papers, 2)non ISI and conference papers 3) reports (grey literature)



1. The Research Life cycle management – ISI publication

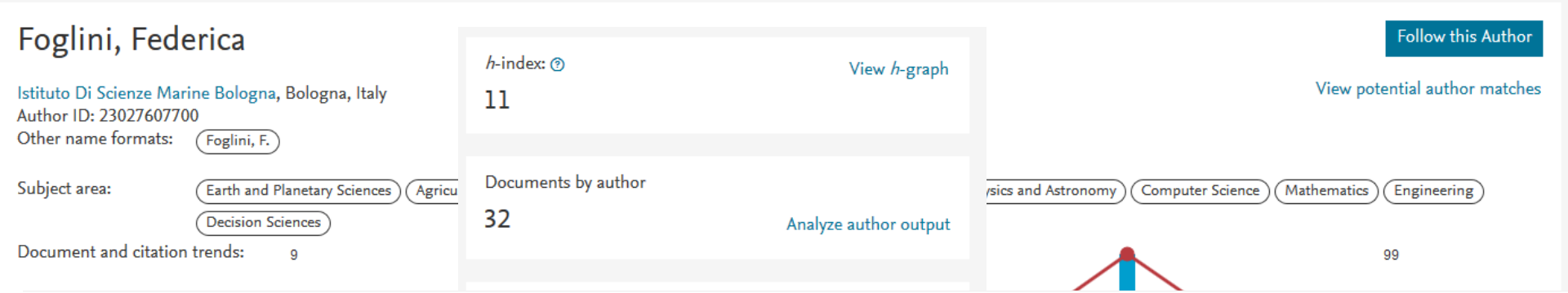


Scientific publication in ISI (international Scientific indexing), peer reviewed **Journals with Impact factor and citation** (DOI and index citation)

Increase Scientist citation index and scientific credits

Possibility of supplementary materials and data if requested by the journal
And choosing paper licence (open access at different level to protect your work and ensure citation)

1. The Research Life cycle management – ISI pubblication



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Subject area: Earth and Planetary Sciences · Agricu · ysics and Astronomy · Computer Science · Mathematics · Engineering · Decision Sciences

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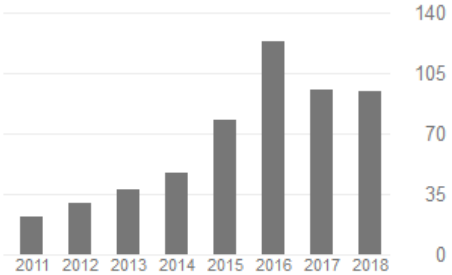
SEGUI

TITOLO	CITATA DA	ANNO
Habitat mapping of the Maltese continental shelf using acoustic textures and bathymetric analyses M Prampolini, P Blondel, F Foglini, F Madricardo Estuarine, Coastal and Shelf Science 207, 483-498	2	2018
Predictive habitat modeling in two Mediterranean canyons including hydrodynamic variables A Bargain, F Foglini, I Pairaud, D Bonaldo, S Carniel, L Angeletti, ... Progress in Oceanography		2018
Geomorphology of scour holes at tidal channel confluences C Ferrarin, F Madricardo, F Rizzetto, W Mc Kiver, D Bellafiore, ... Journal of Geophysical Research: Earth Surface	1	2018

Citata da VISUALIZZA TUTTO

	Tutte	Dal 2013
Citazioni	616	480
Indice H	13	13
i10-index	15	15



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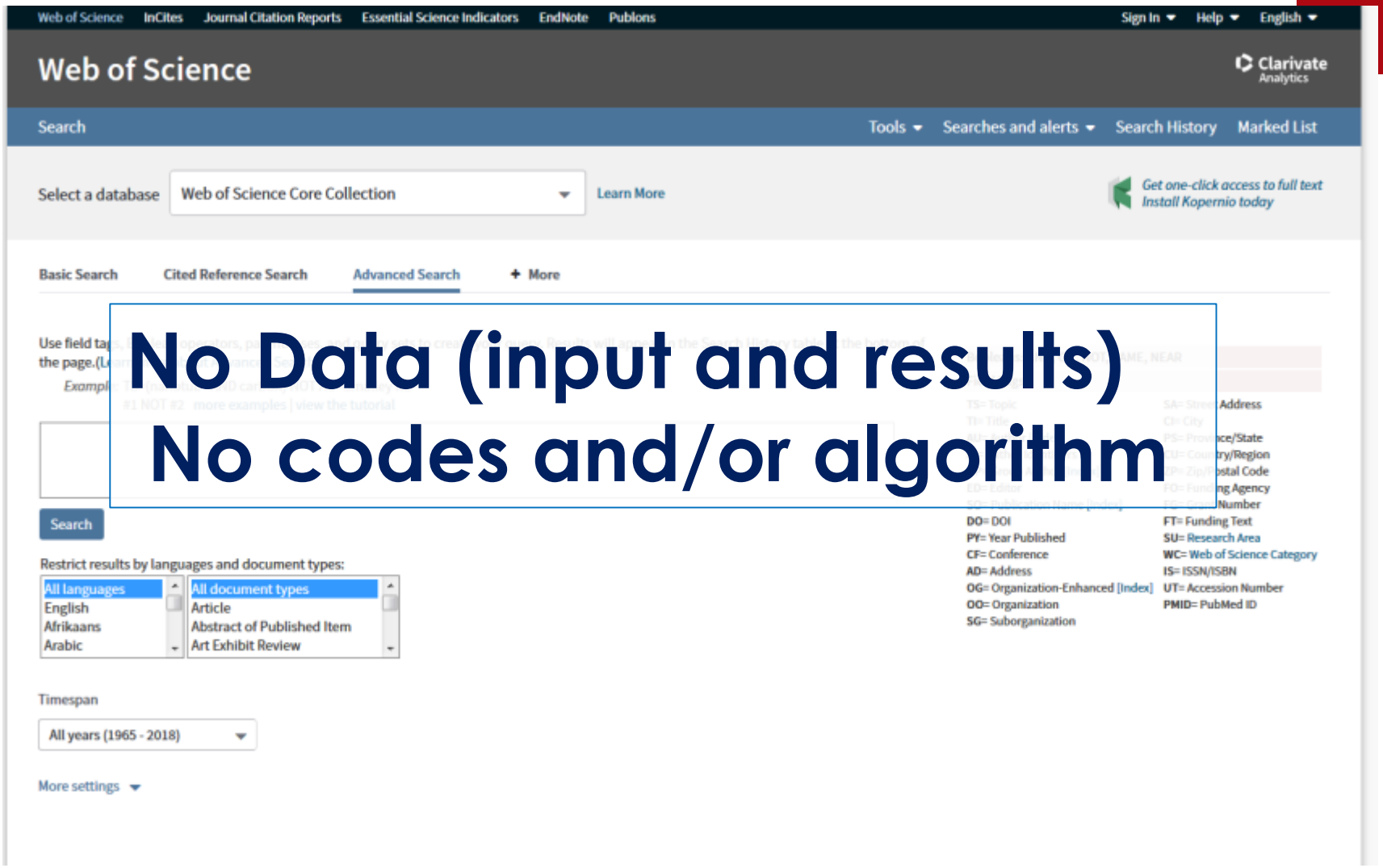
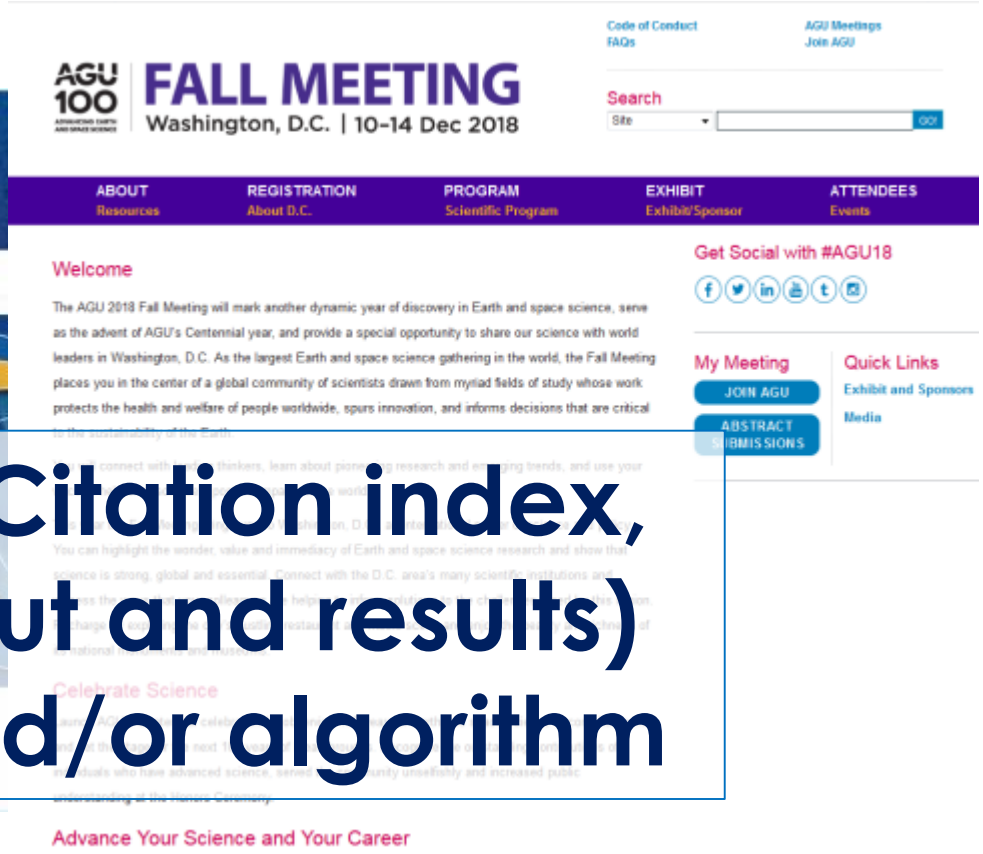
1. The Research Life cycle management – ISI pubblication



2. The Research Life cycle management - non ISI papers

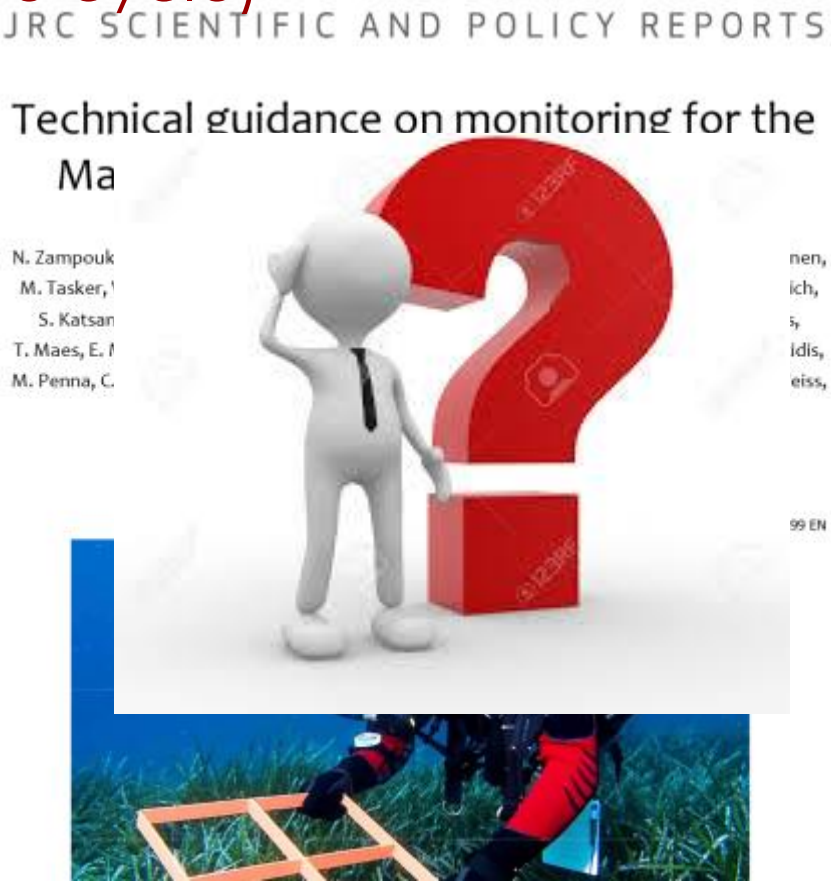
Search for collaboration and new ideas - CONFERENCE (e.g. conference proceedings)

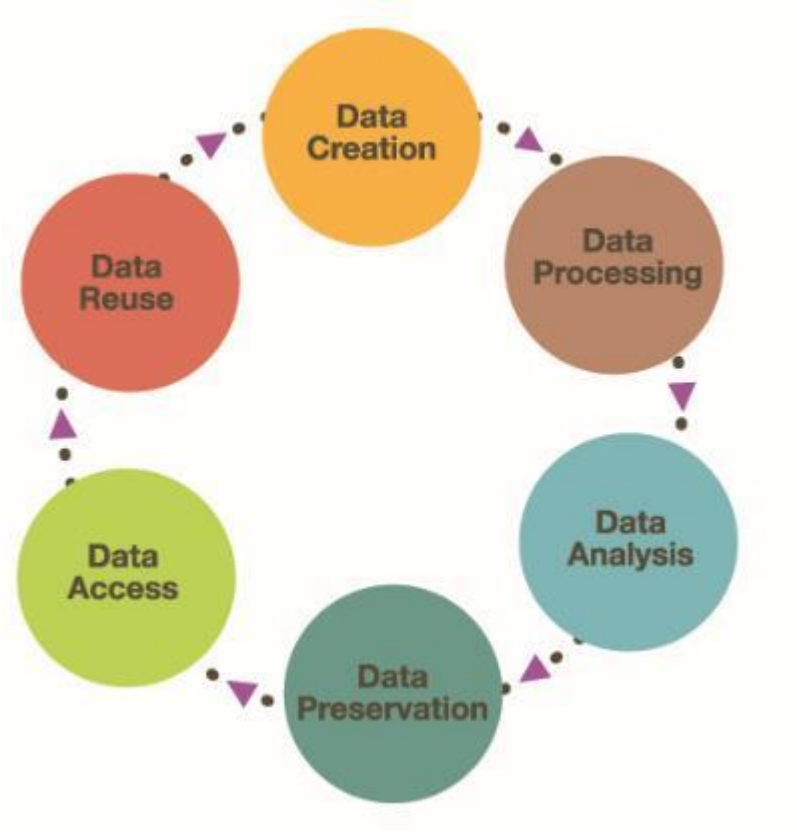


No DOI and Citation index,
No Data (input and results)
No codes and/or algorithm

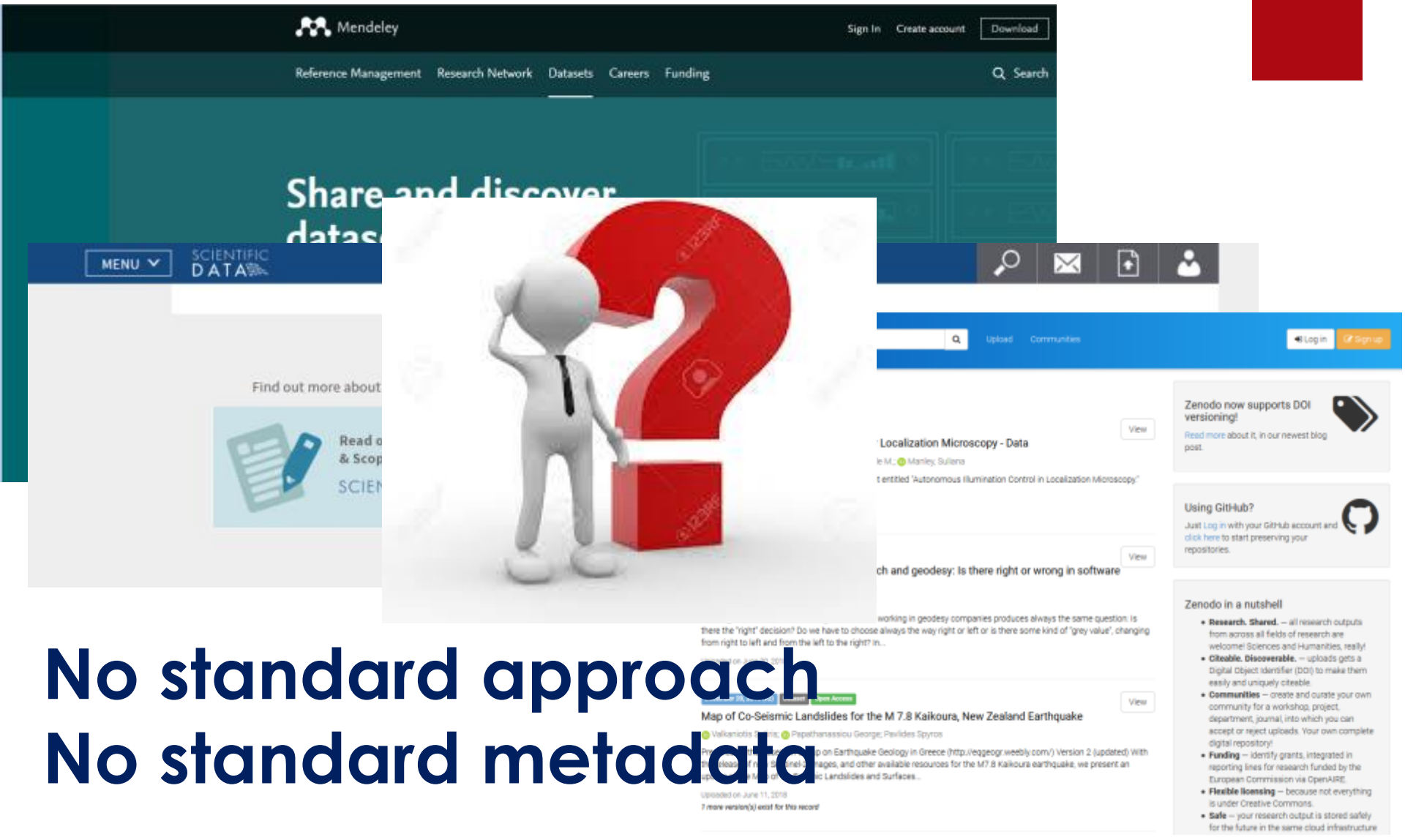
3. The Research Life cycle management - Grey literature

Report and technical notes, project deliverables, Report on data collection and processing (data life cycle)





The Research Life cycle management - Journals approach



No standard approach

No standard metadata

The Research Life cycle management

Main daily challenges for a CNR scientist:

1. searching of existing data and products;
2. sharing methodologies;
3. working on the same workflows and data;
4. adopting shared powerful tools for data processing

Today solution:

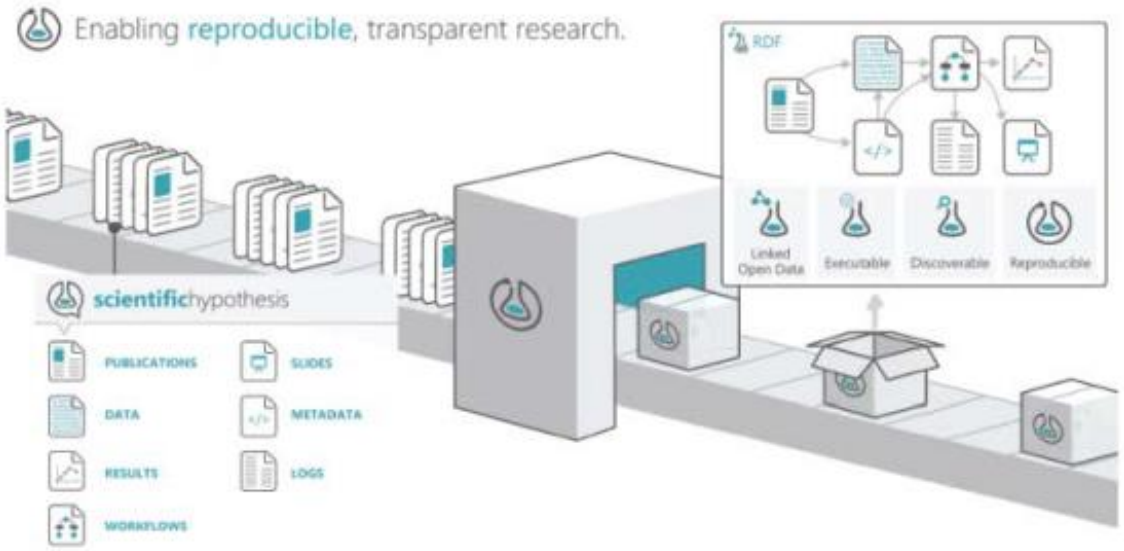
1. searching of existing data and products among many different web site, colleagues and institutional partners
2. sharing methodologies through description in scientific papers publication
3. working on the same workflows and data almost with colleagues in the same place and time (laboratory, workshops and meetings)
4. adopting shared powerful tools for data processing only if are available in the laboratory

The Research Life cycle management - Research Objects

Aggregation of resources that bundles the content of a research work to facilitate the reusability, reproducibility and better understanding.

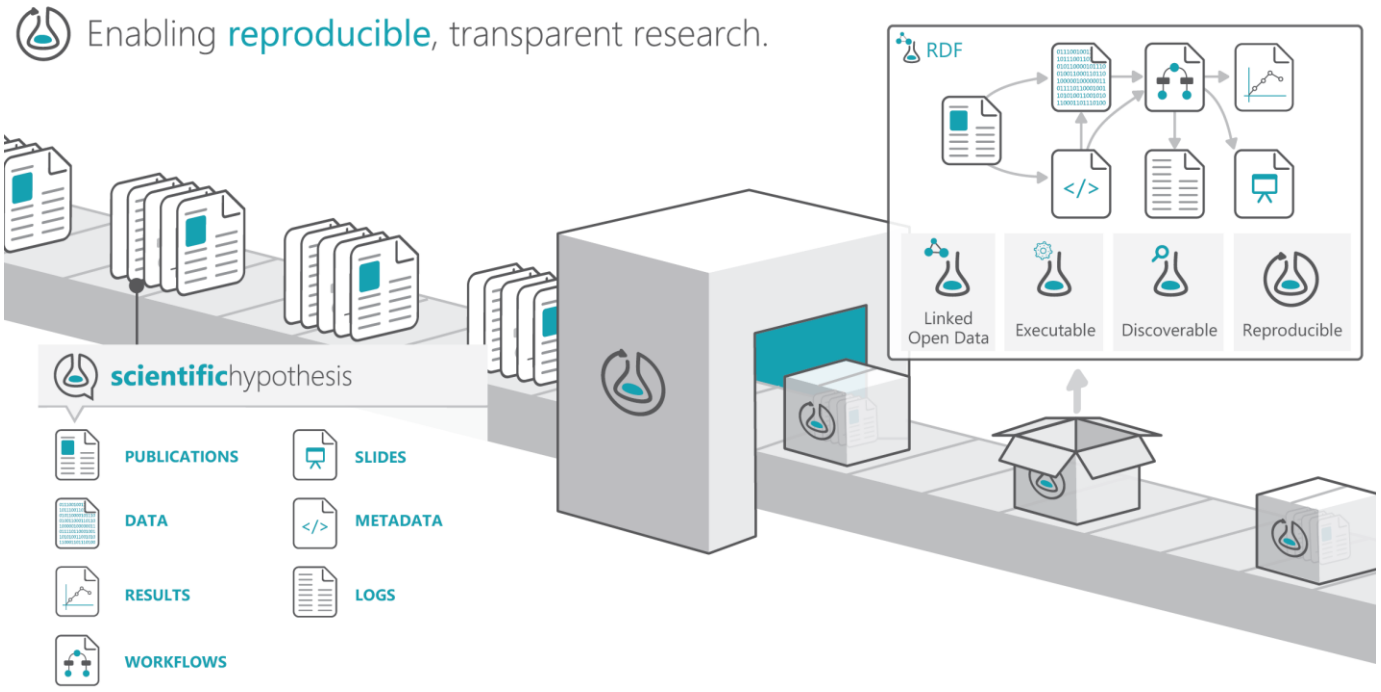
The resources are:

- **Data**
- **Experiments**
- **Workflows**
- **Metadata**
- **Annotations**
- **Bibliography**
- **Results**
- **Provenance**
- **...**



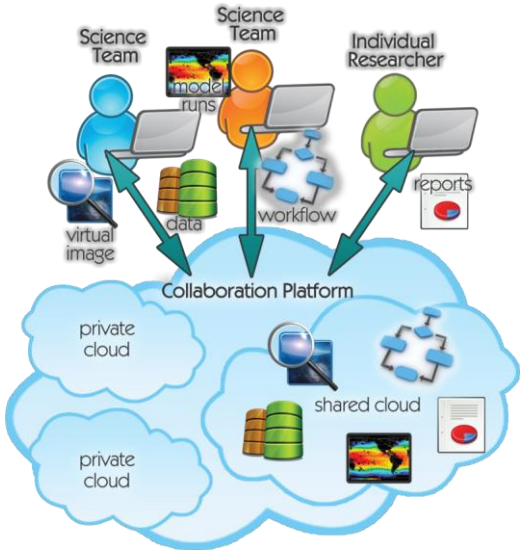
The Research Life cycle management - EVER-EST solutions

The solution is based on the integration of Earth Science e-infrastructures technologies - developed over 15 years - with the innovative concept of Research Object

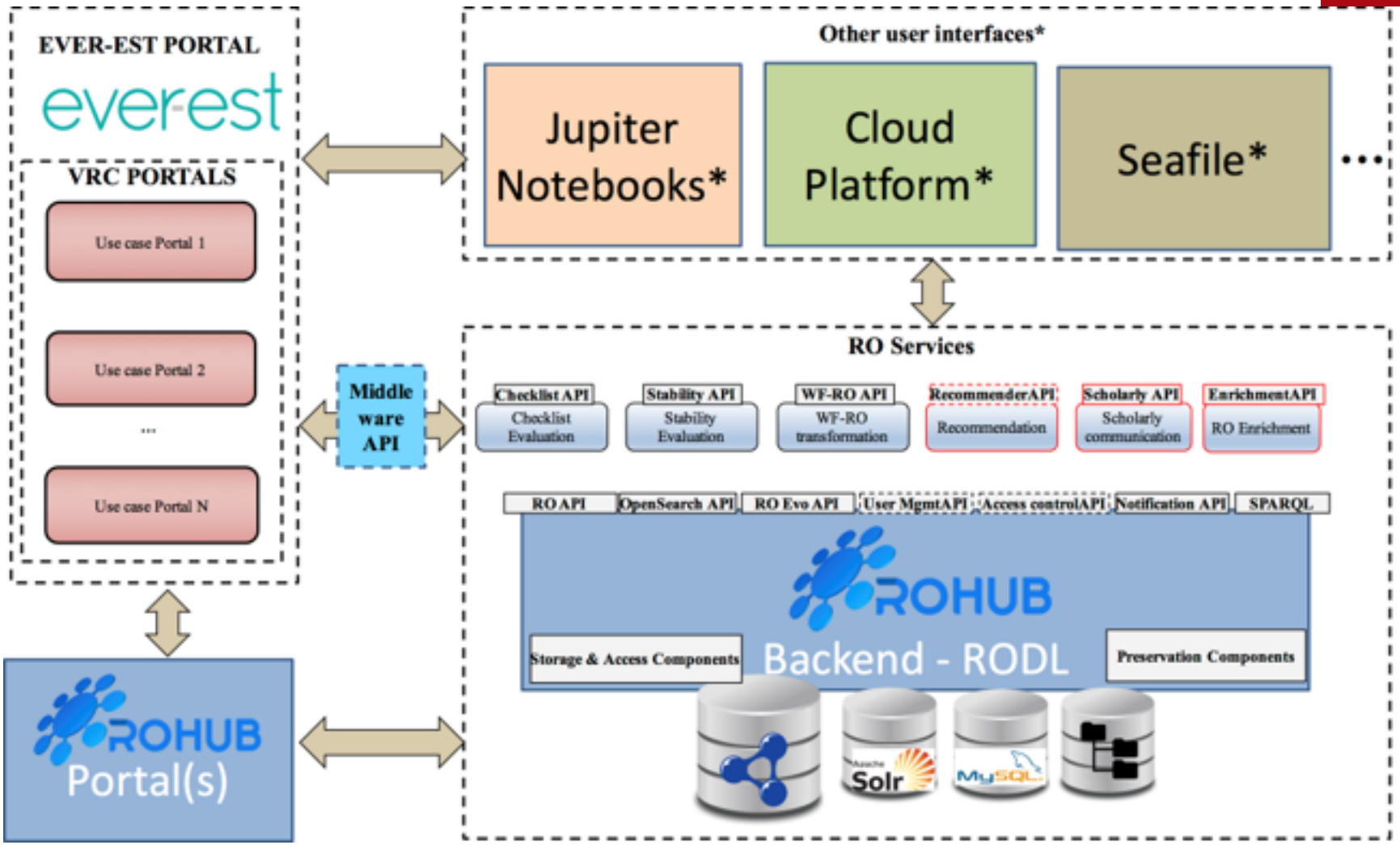


The Research Life cycle management - EVER-EST solutions

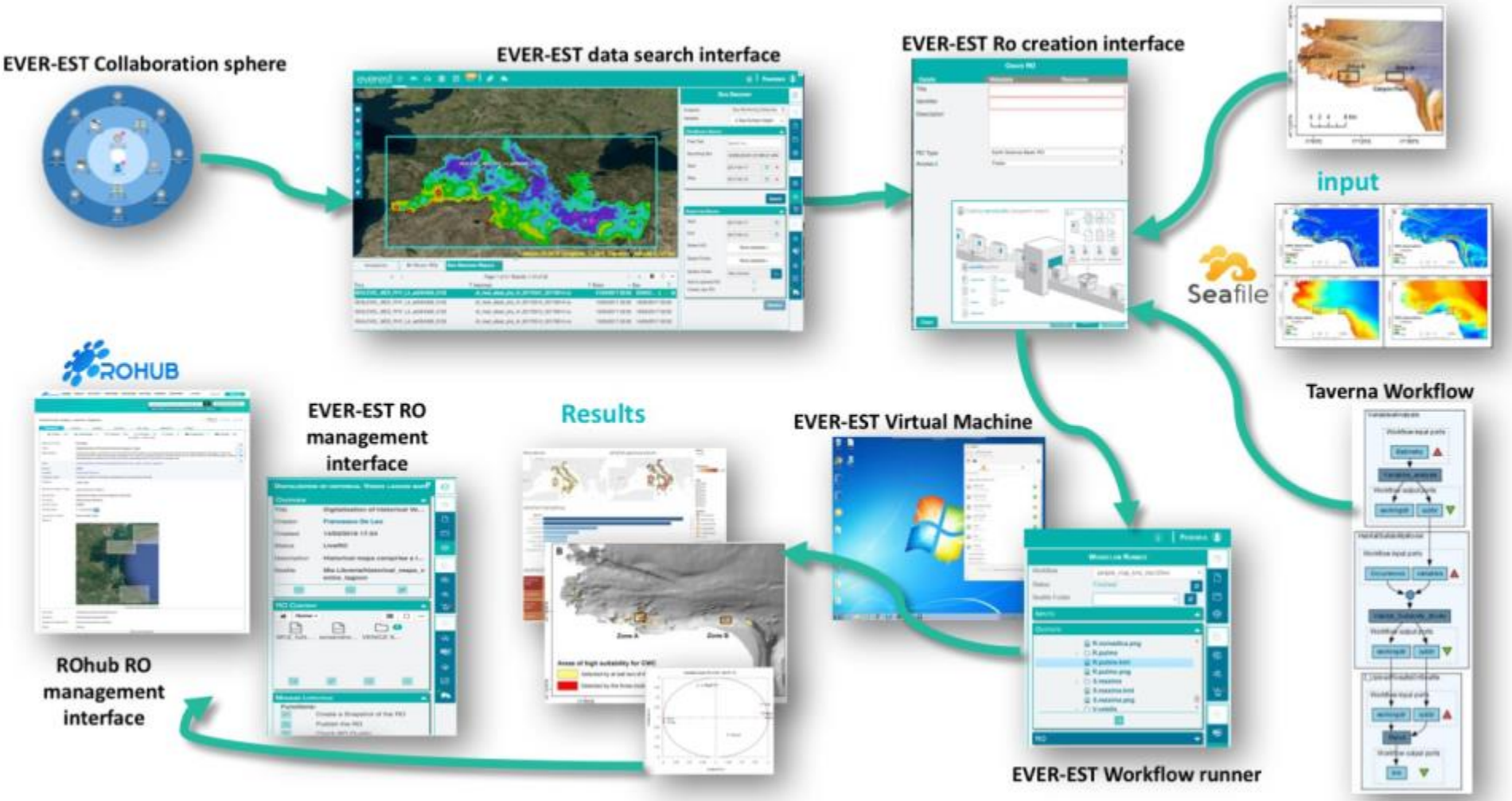
- Remotely access data, software, research results, and documentation
- Organize a scientific workflow in a single digital object, findable and reusable, maintaining attribution through DOI placement
- Collaborate with colleagues located in different parts of the world
- Document scientific work, e.g., encapsulate in a single digital object data and/or results related to a single Supersite event (an eruption)
- Publish grey literature (e.g., project reports, bulletins, etc.) maintaining attribution
- Ensure long term preservation of research work (data, software, results, interpretations)



EVER-EST solutions – the architecture



The EVER-EST solution for the Sea Monitoring community

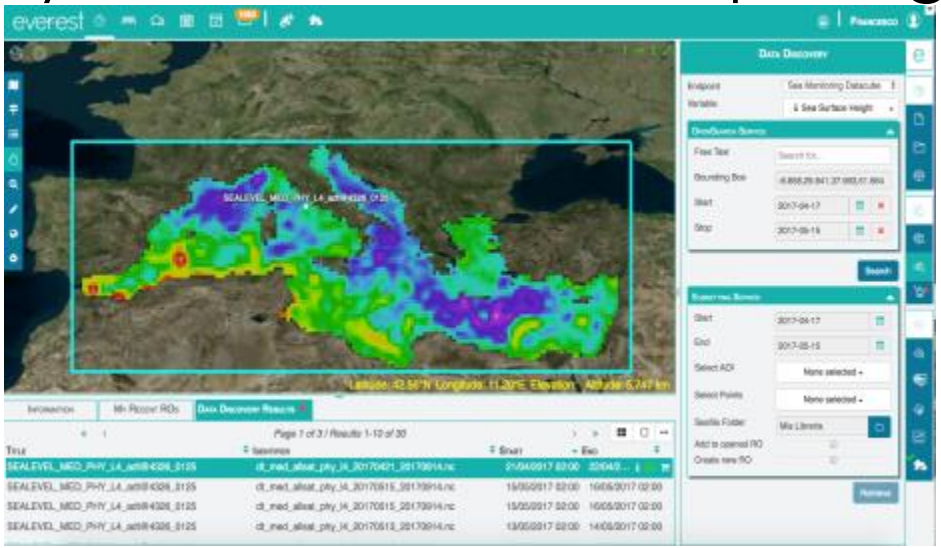


The EVER-EST solution

1. Data sharing and Harmonization- reduction of data and knowledge fragmentation.

EVER-EST ROHUB and Collaboration sphere

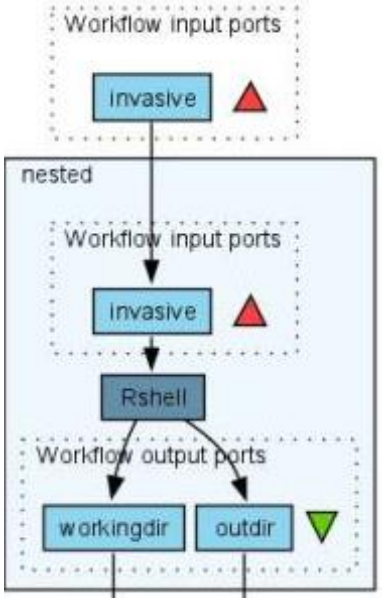
2. Easy data Discovery Re-Use and Re- Purposing of open data



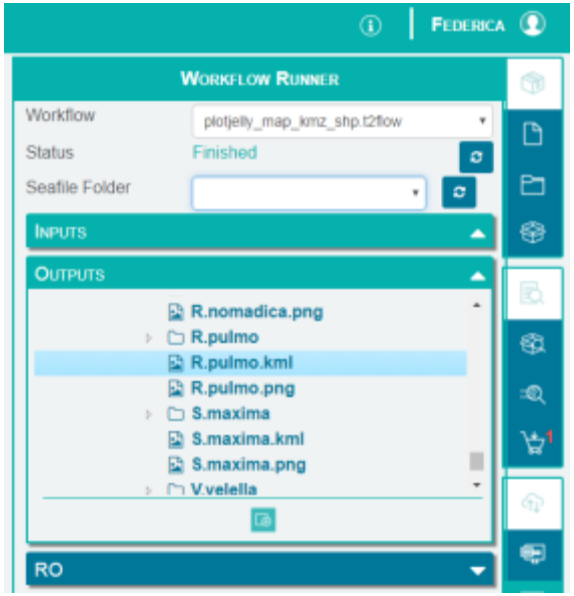
The Ever-Est solution

3. On line Data processing – resources and collaboration using a virtual lab

Taverna Workflow



EVER-EST Workflow runner



EVER-EST Virtual Machine

4. Implementing **FAIR** data principles through the adoption of Research Object able to encapsulate, share and reproduce the entire research cycle

The Sea Monitoring community
Use cases

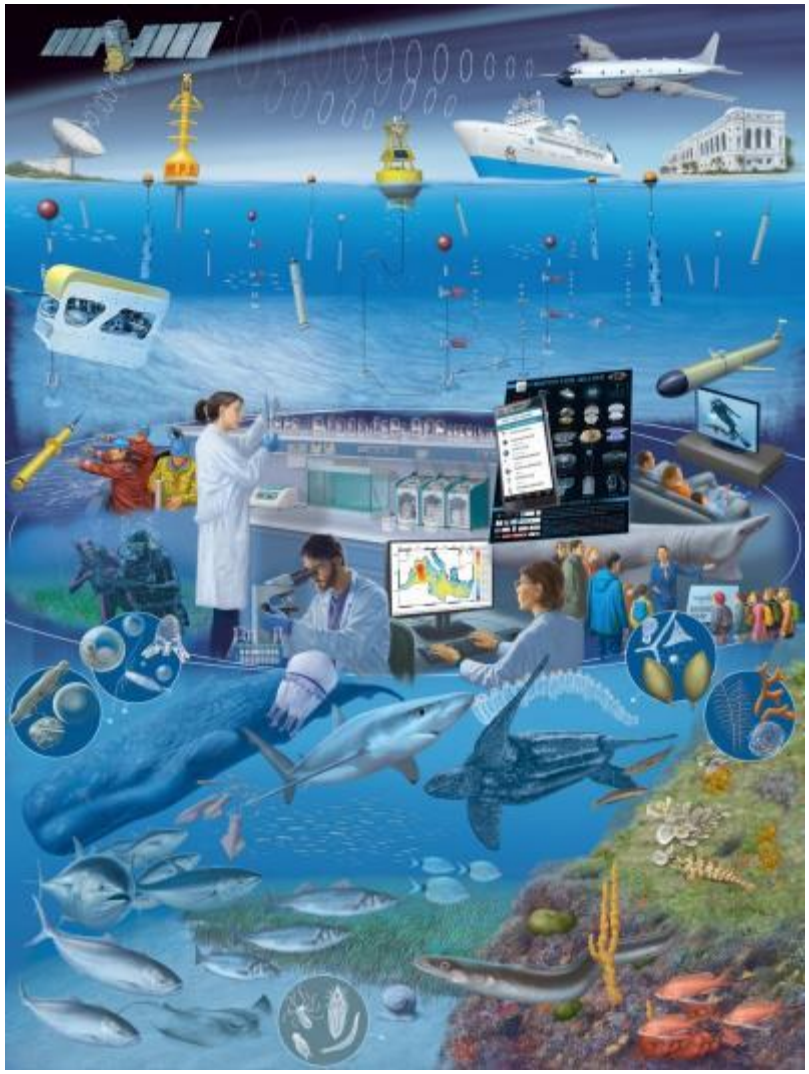
https://ever-est.eu/

https://vre.ever-est.eu/demovrc/

http://www.rohub.org/

The Sea monitoring Community

The sea monitoring community is wide and heterogeneous including both multi-disciplinary scientists, national/international agencies and authorities dealing with the adoption of a better way of measuring the quality of the environment.

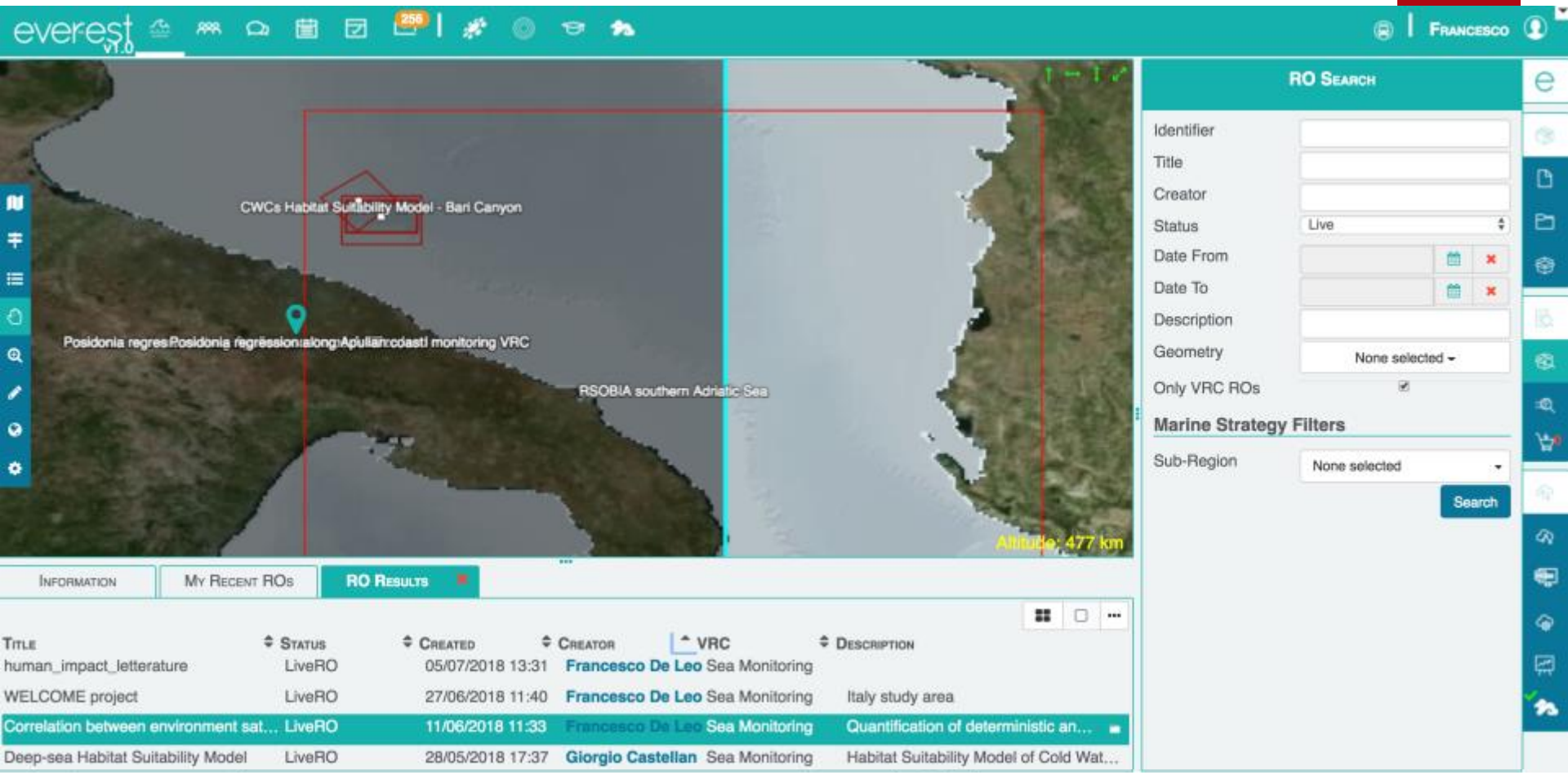


Marine Strategy Framework Directive

According to the Marine Strategy Framework Directive (MSFD), the environmental status of marine waters is defined by 11 descriptors, and forms a proposed set of 29 associated criteria and 56 indicators.

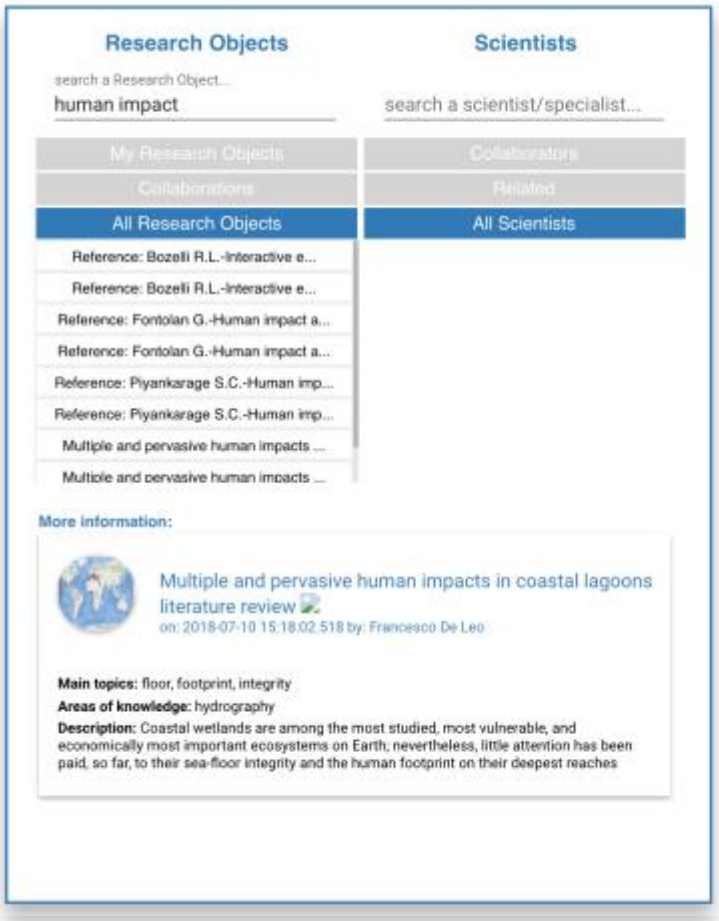
The objective of the Sea Monitoring VRC is to test Ever-Est platform provide useful and applicable contributions to the evaluation of the descriptors: D1.Biodiversity, D2.Non-indigenous species, D4. Marine Food Web and D6.Seafloor Integrity.

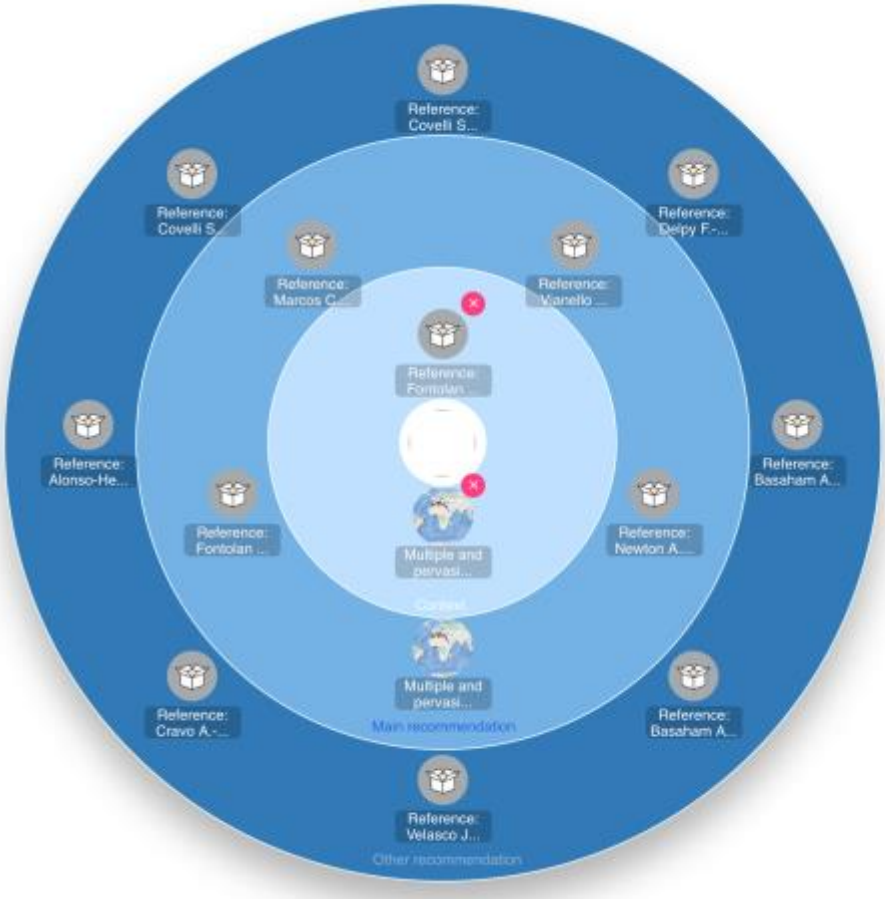
EVER-EST Seamonitoring CASE STUDIES (12 Golden ROs)



1 Data RO, 7 Worflow ROs, 4 Process ROs

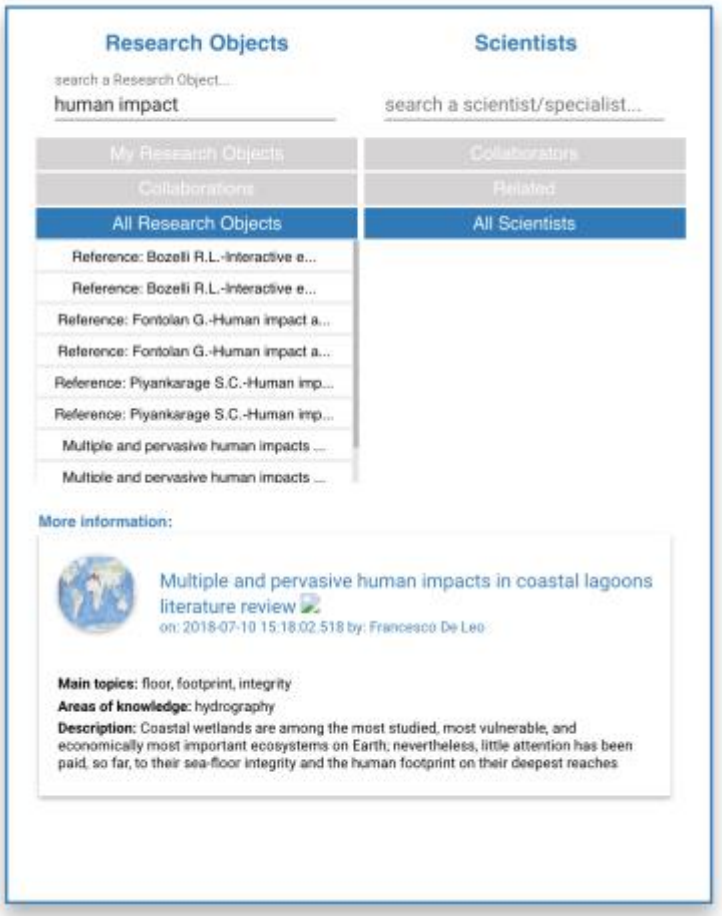
EVER-EST Seamonitoring CASE STUDIES (> 200 Biblio RO about MSFD)

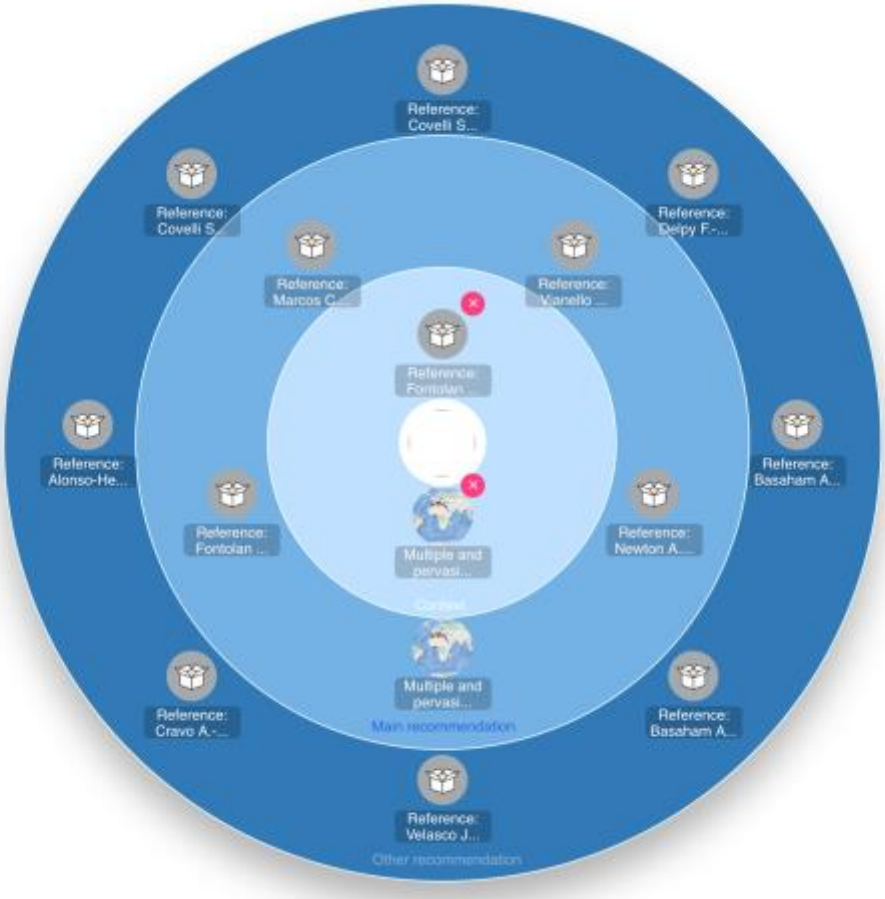




Supported by: COGITO

EVER-EST Seamonitoring CASE STUDIES (> 150 Biblio RO about human impact)



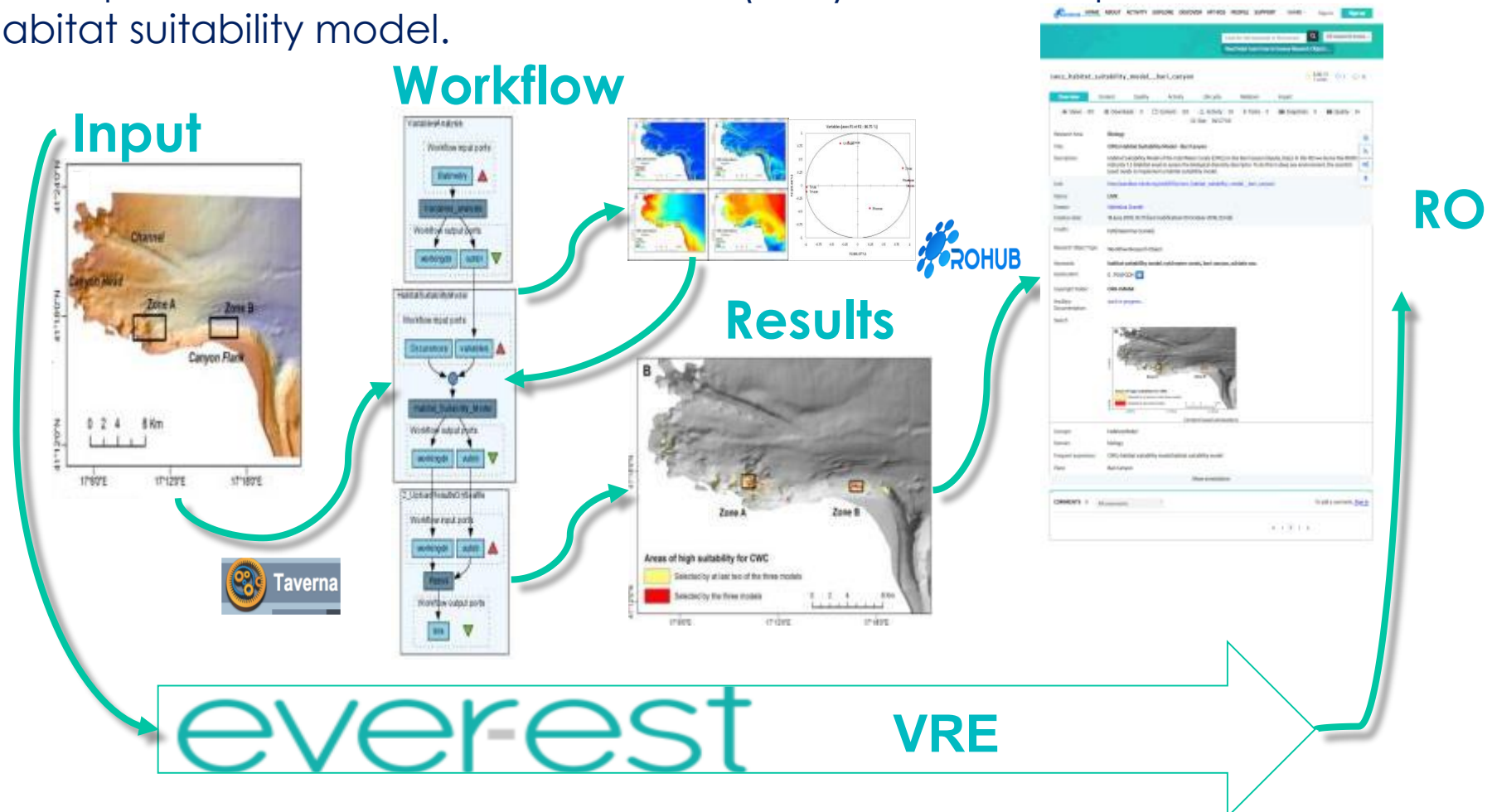


EVER-EST Seamonitoring CASE STUDIES

- Habitat extent Cold Water CoralsHabitat suitabilty model (***Workflow RO***)
- Jellyfish role to asses indicators in Marine strategy: Trending Species distribution and citizen science, evolution of invasive species (***Workflow RO***)
- Mapping *posidonia* regression along the Apulian coast (**Process RO**)
- Preserving ancient map of the lagoon of Venice for assessing changes of human footprint (***Data RO***)

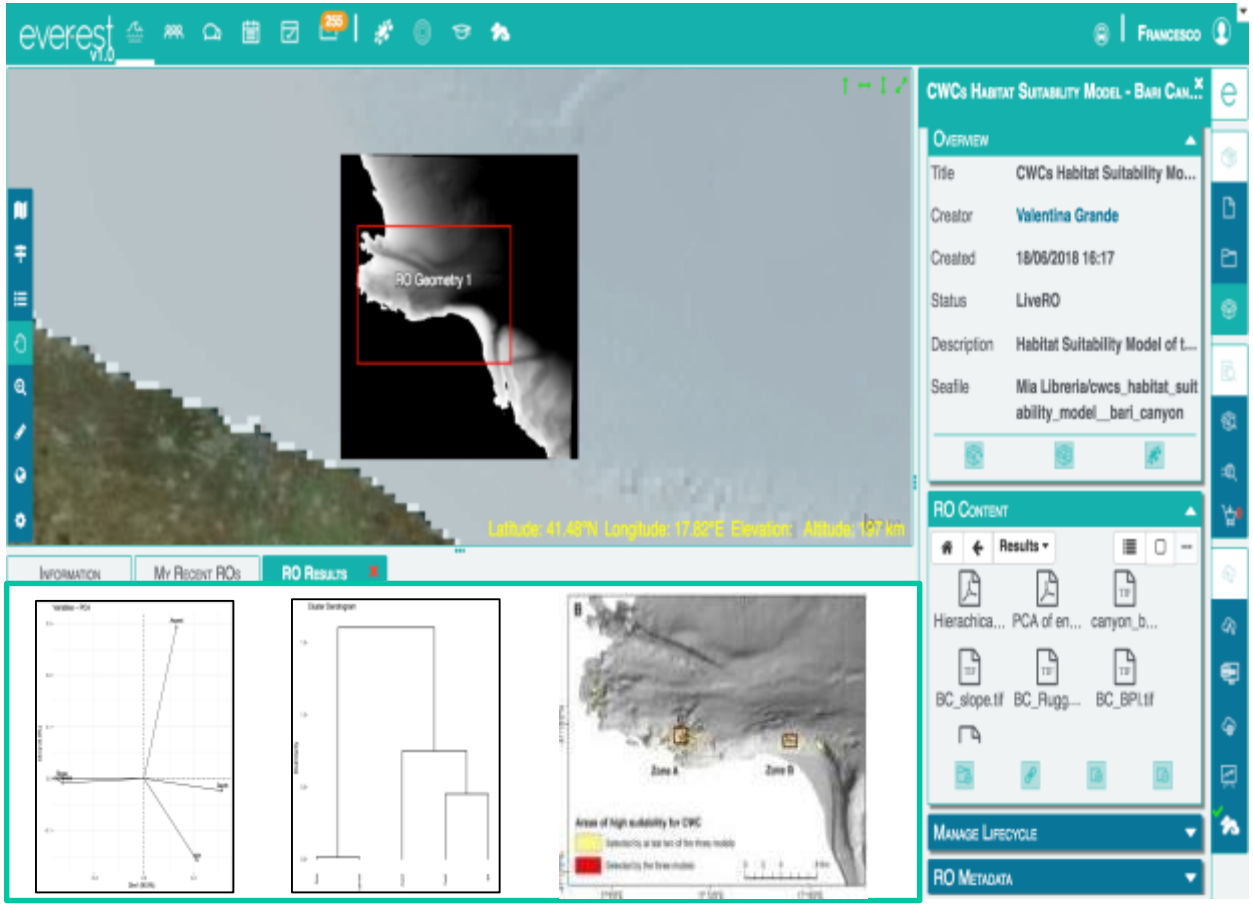
Habitat Extent: Cold Water Corals Habitat suitabilty model

Habitat Suitability Model of the Cold Water Corals (CWCs) in the Bari Canyon (Apulia, Italy). In this RO we derive the MSFD indicator 1.5 (Habitat area) to assess the biological diversity descriptor. To do this in deep sea environment, the scientist (user) needs to implement a habitat suitability model.



Habitat Extent: Cold Water Corals Habitat suitabilty model

http://www.rohub.org/rodetails/cwcs_habitat_suitability_model__bari_canyon/overview



- RO Type: Workflow RO
- Required tool : R, SeaFile, Taverna Workbench on VM, Workflow runner.
- Input: Workflow, high resolution bathymetry, CWC occurrence
- Output: CWCs Habitat Suitability Model

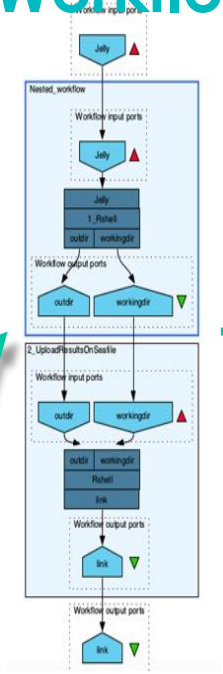
Species distribution & Non-indigenous species

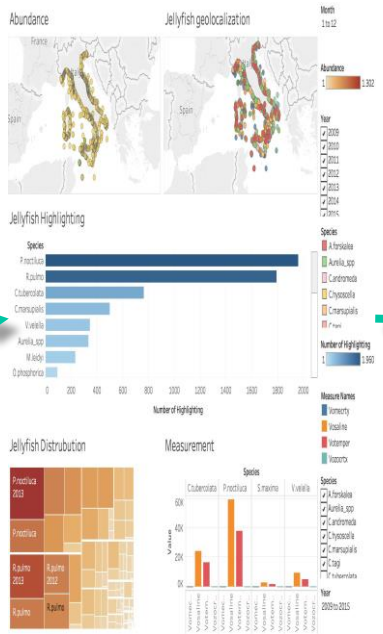
Starting from Jellyfish sightings, we elaborate data to produce explicit geographical information concerning trend about the evolution and distribution of alien species according to MSFD directive

Input

Taverna

Workflow

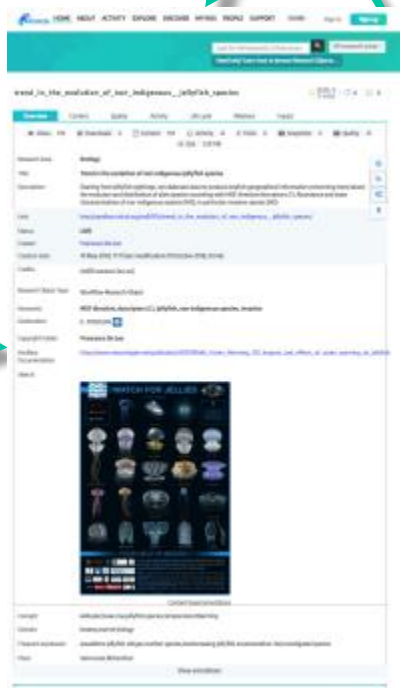




Results

ROHUB

RO

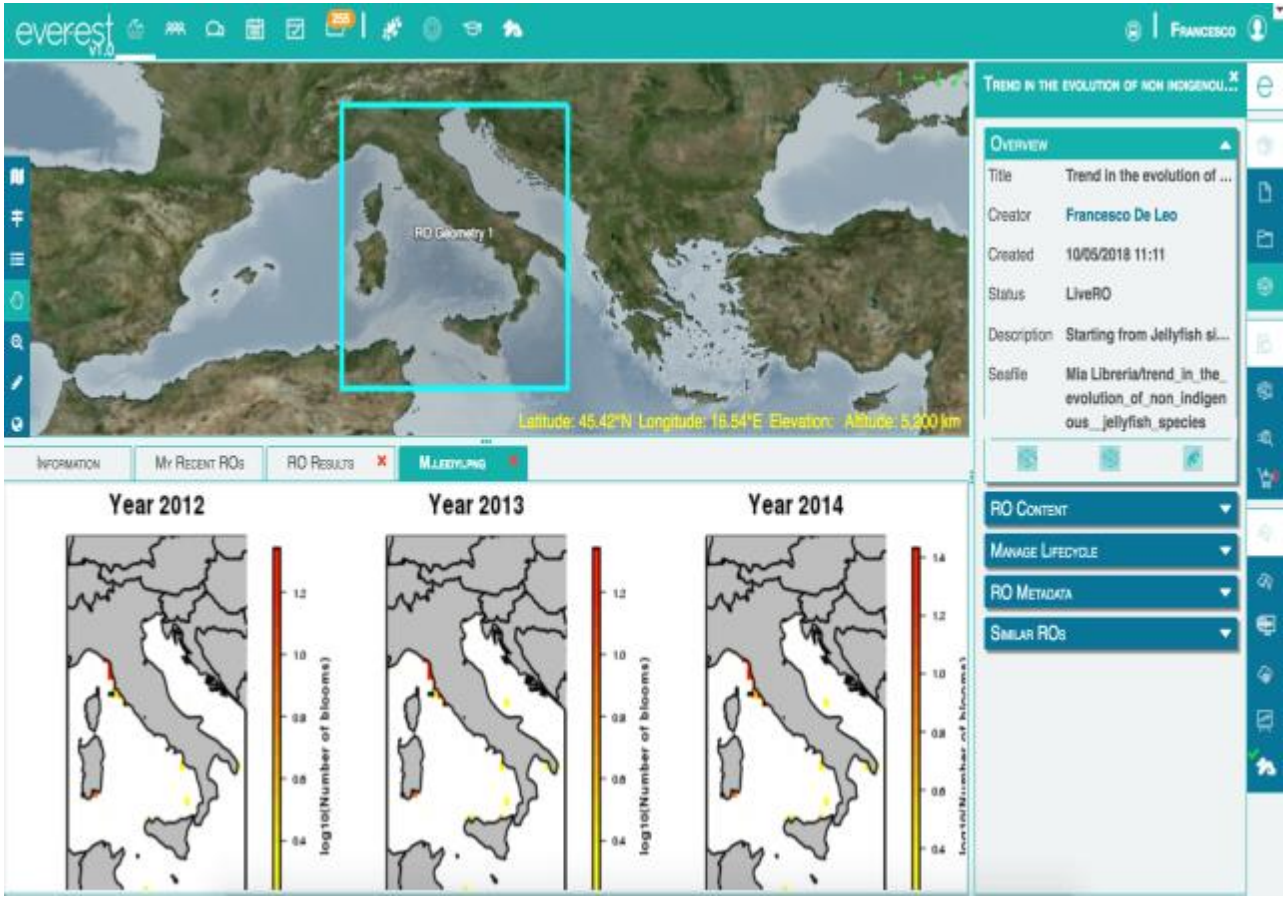


everest

VRE

Study case: Trend in the evolution of non indigenous jellyfish species

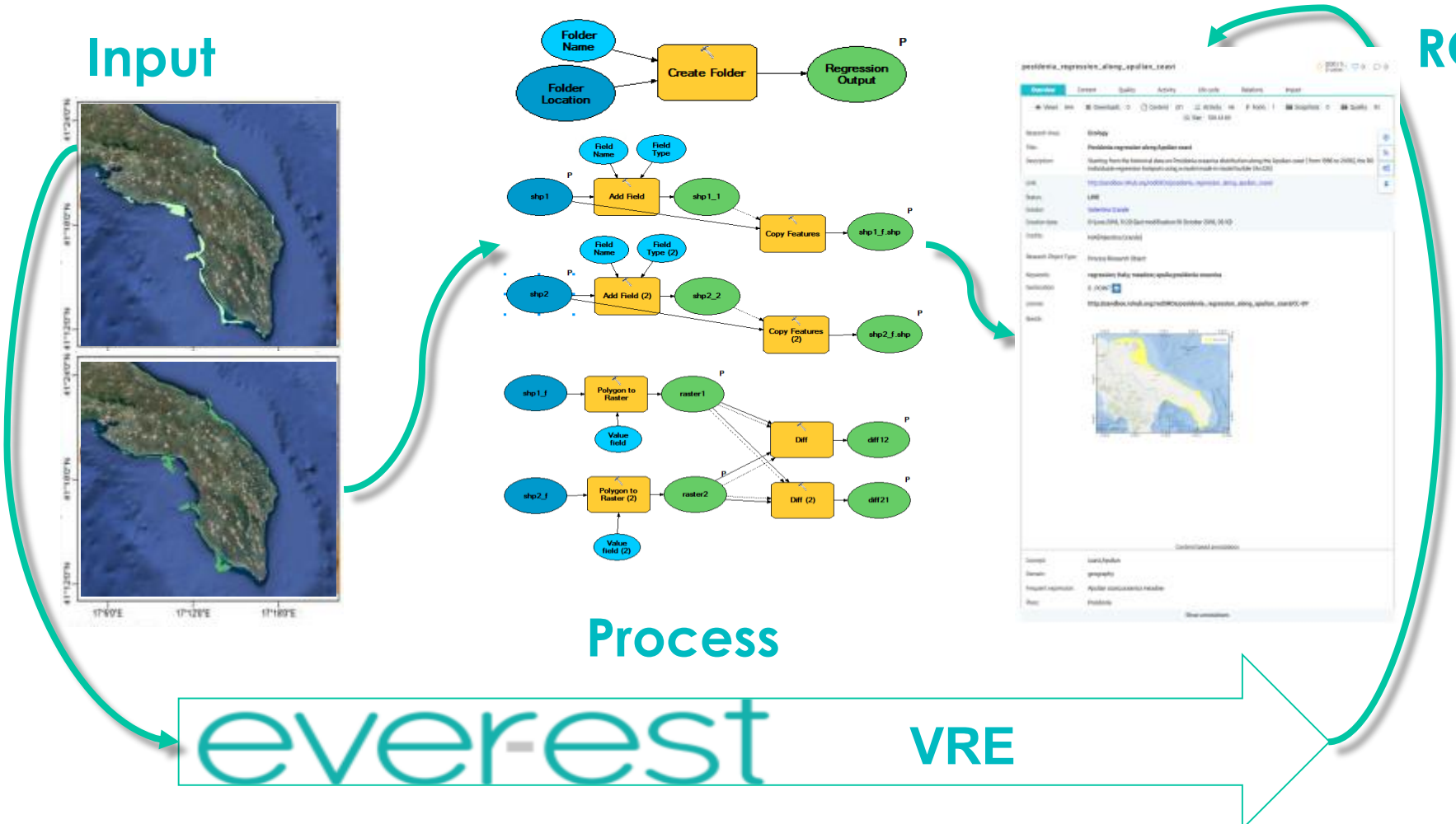
http://www.rohub.org/rodetails/trend_in_the_evolution_of_non_indigenous__jellyfish_species/overview



- RO Type: *Workflow Ro*
- *Required tool : R, SeaFile, Taverna Workbench on VM, Workflow runner.*
- *Input: Workflow, Jellyfish sightings*
- Output: *density annual map of the NIS jellyfish blooms*

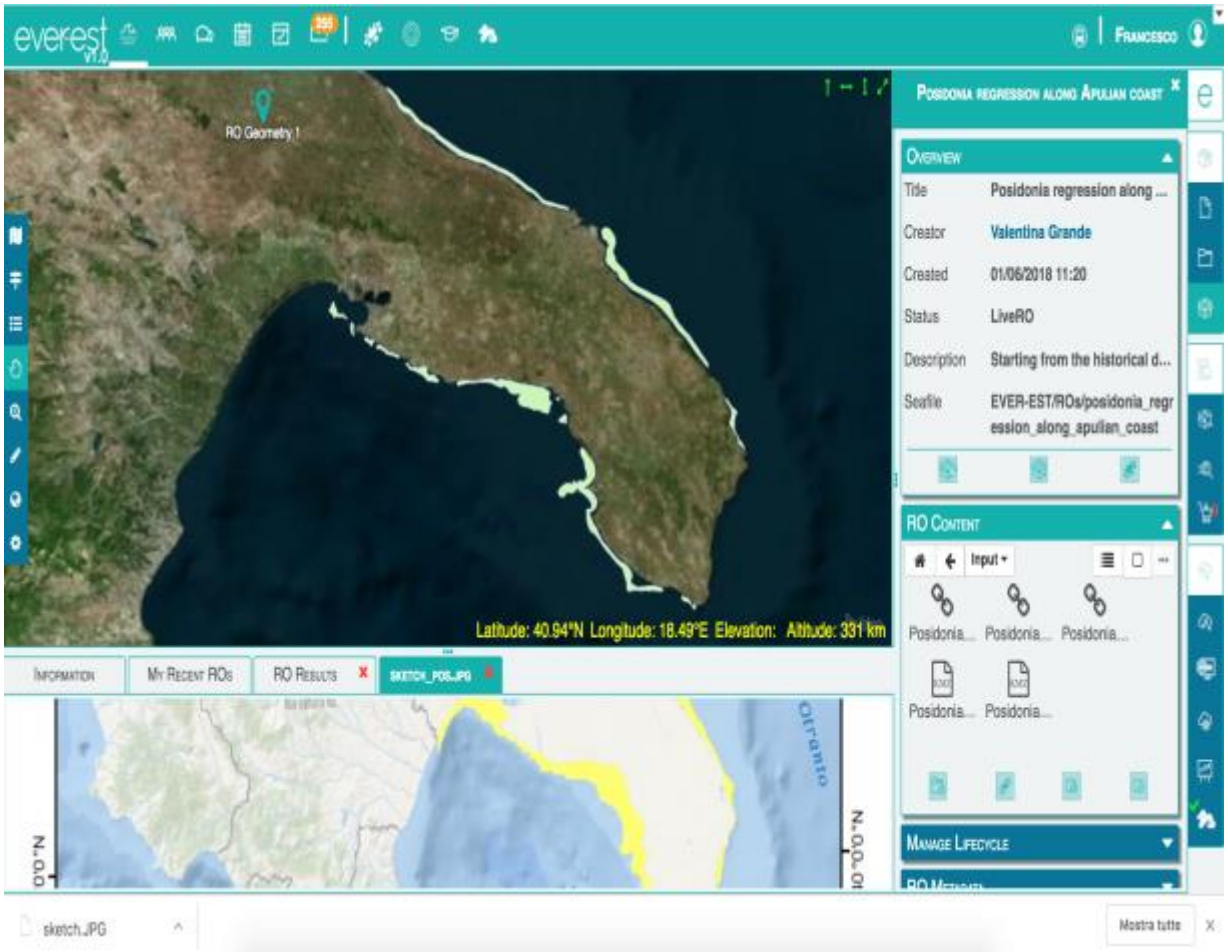
Mapping posidonia regression along the Apulian coast

Starting from the historical data on Posidonia oceanica distribution along the Apulian coast (from 1986 to 2006), the RO individuate regression hotspots using a model made in model builder (ArcGIS)



Posidonia regression along Apulian coast

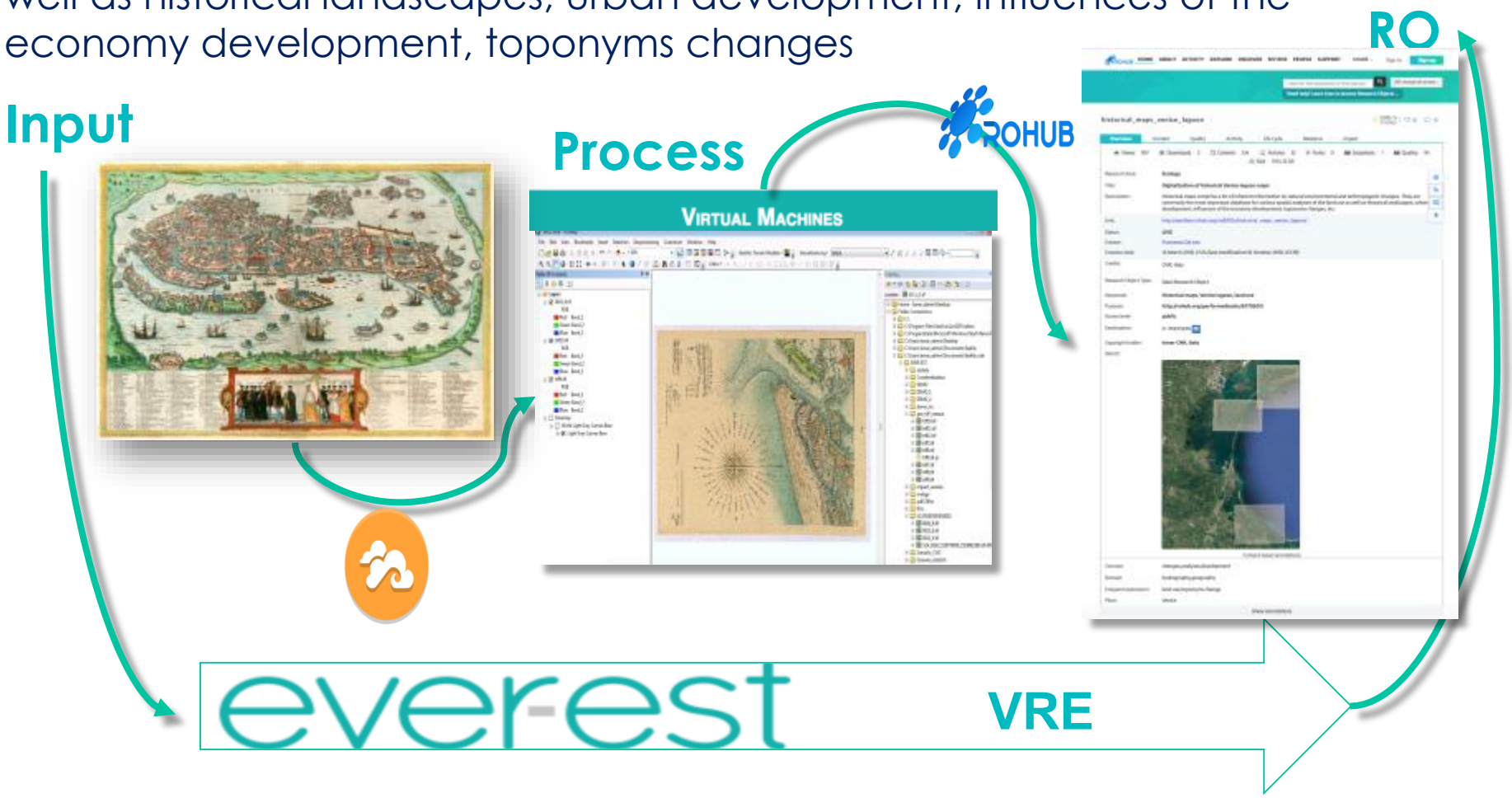
http://sandbox.rohub.org/rodl/ROs/posidonia_regression_along_apulian_coast/



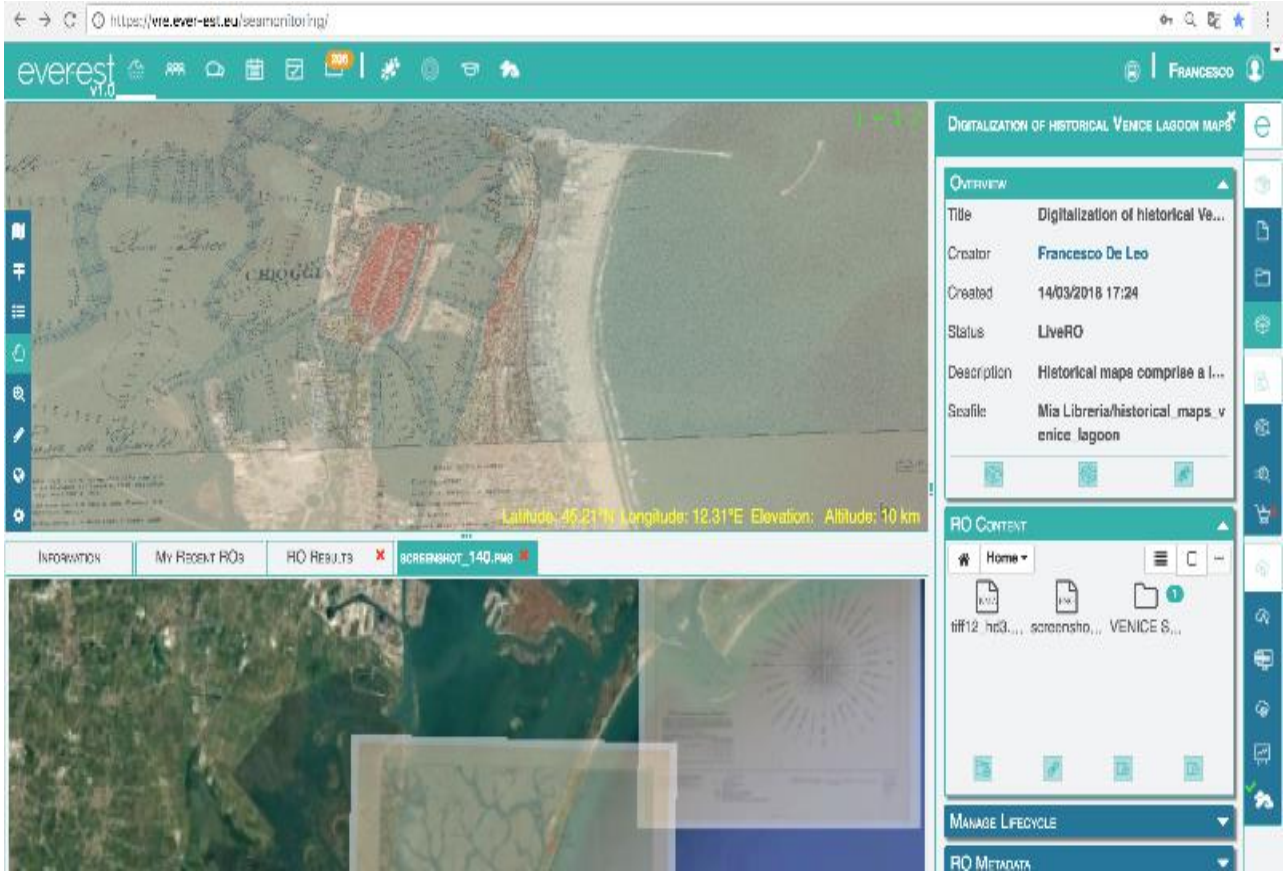
- RO Type: *Process Ro*
- *Required tool : ArcGIS on Platform Virtual Machine and SeaFile*
- Content: *High Resolution Tiff, GeoTiff*

Long-term “active” data preservation for ancient map

Historical maps comprise a lot of inherent information on natural environmental and anthropogenic changes. They are commonly the most important database for various spatial analyses of the land use as well as historical landscapes, urban development, influences of the economy development, toponyms changes



Preserving ancient map of the lagoon of Venice for assessing changes of human footprint



- RO Type: *DATA Ro*
- *Required tool : ArcGis on Platform Virtual Machine and SeaFile*
- Content: *High Resolution Tiff, GeoTiff*

http://www.rohub.org/rodetails/historical_maps_venice_lagoon/overview

Conclusions

- The EVER-EST project has demonstrated the relevance of Research results (Research Object) standardisation and interoperability to boost innovation and open science (**FAIR principle**)
- ROS (**data ROs, Workflow ROs, Bibliographic ROs**) complemented by Data and Publication DOIs enable the bi-directional link between the data and the research output results and assure the automatic recording and tracking of the quality of the research results and ROs
- The EVER-ES solutions and the adoption of the RO concept proved to be effective for managing the entire **Research Life Cycle** and to effectively share and re-use scientific results.
- The functionality of **GeoReferencing ROs** proves invaluable for Data Provider to assess data set valorisation requirements including historical maps ingestion to built long term data series.

Next steps….

- **Enlarge the community** of RO adopters for Earth Scientists
- Improve tools for RO **quality and check**
- **Make the RO a standard**
- Improve Workflow annotation and documentation
- Improve flexibility for Workflows usage
- **Disseminate** the RO concept and the usage to boost the real **OPEN SCIENCE**

Thanks for your attention!

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