National Research Council of Italy

Il ruolo delle infrastrutture di ricerca nel potenziamento delle attività di R&S in geotermia e scienze ambientali: casi studio di EGRISE e ITINERIS

Eugenio Trumpy, CNR-IGG

Fora on geothermal energy in EU

- **Supporting**, **strengthening** and **optimise** the *fora* on geothermal systems dealing with research and innovation: Deep Geothermal Implementation Working Group (DG-IWG) and ETIP-G

- **Facilitate** the **realisation** of the DG-IWG Implementation Plan and the **execution** of the ETIP-G Roadmap with an **update** of the **SRIA** and the **Vision**

- Supporting both fora has the objective to **strengthen** the development of new geothermal technologies to uptake the market and reach our climate and energy **objectives** for 2030 and 2050, in a common agreement of the sector: Industry, Research, and Public authorities.

- Ensuring the DG-IWG and ETIP-G have **enough data**, **tools** and **procedures** in place for them to take well-grounded discussions and strategic decisions to move geothermal forward in a productive way

GEOTHERMAL IWG

ETIP Geothermal

Member states

Research & Industry

Motivations

Describe RD&I in the geothermal sector also from a historical perspective

Highlighting **success** stories and **gaps**

Data organization & Knowledge sharing

Provide a framework for data access, retrieve and query

Where can we find project results?

Support the Strategic Research and Innovation Agenda

Supporting the identification of the most relevant **research priorities**

Writing project proposal

The European Geothermal RD&I Documents Search Engine – EGRISE version 1.0

Data collection
- CORDIS
- Keep.eu
- Document collection
- Project coordinator informed

Data organization
- Zenodo community creation
- Upload resources
- metadata

Data Discover — Front end set-up

GEOTHERMAL RESEARCH SEARCH ENGINE

ENTER YOUR SEARCH TERM
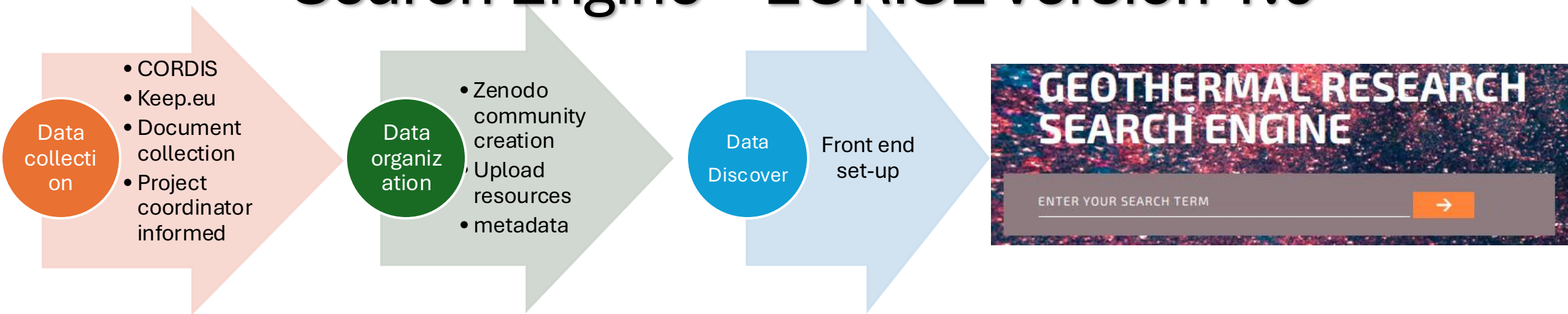
Back-end-front-end connection is guaranteed by the Application Program Interface (**API**) provided by **Zenodo**

The search engine is embedded in the ETIP-G website.

It's available for ETIP-G members and for general public.

Total documents: 266 (264 pdf, 2 xls and 1 zip)

Publication: 251 (Deliverable: 198, Report: 33, Article: 8, Conference paper: 7, Book: 2, Other: 3)
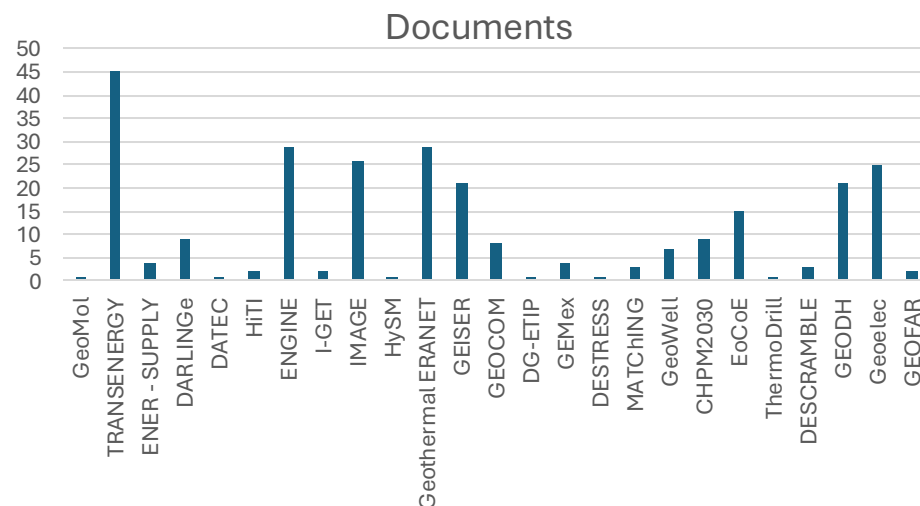
Presentation: 8

Poster: 3

Software: 2

Other: 2

Documents

Bar chart categories: GeoMol, TRANSENERGY, ENER - SUPPLY, DARLINGe, DATEC, HiTI, ENGINE, I-GET, IMAGE, HySM, Geothermal ERANET, GEISER, GEOCOM, DG-ETIP, GEMex, DESTRESS, MATChING, GeoWell, CHPM2030, EoCoE, ThermoDrill, DESCRAMBLE, GEODH, Geoelec, GEOFAR

Documents

- FP6: 26%
- FP7: 27%
- H2020: 13%
- IEE: 15%
- Others: 19%
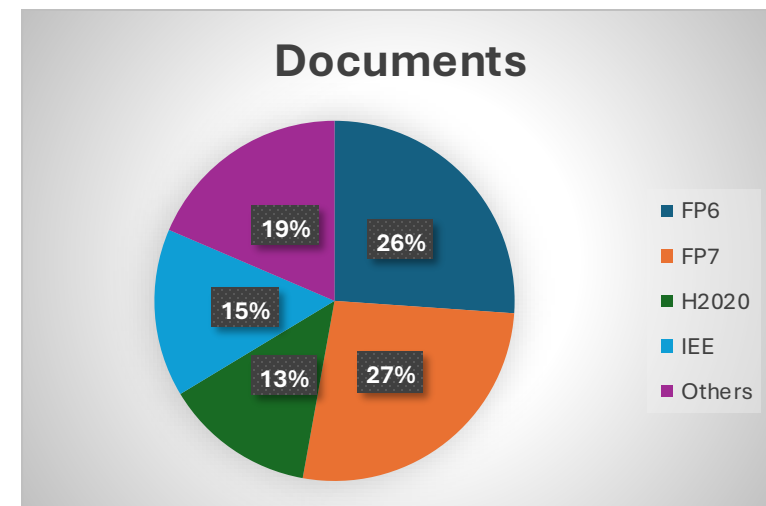
What's new in EGRISE vs 2.0

- EGRISE vs 1.0 is expanded using as backend the constantly updated **OpenAIRE** aggregation

- The updated version of EGRISE vs 2.0 will benefit by the constantly updated **OpenAIRE** infrastructure

- CNR signed a **MoU** with **OpenAIRE** to setup **OpenAIRE CONNECT** and **OpenAIRE MONITOR**

- Define a strategy for the sustainability of these services beyond the duration of the GEOTHERMFORA and OpenAIRE Nexus projects

GEOTHERM FORA

EGRISE version 2.0 Set-up

OpenAIRE | CONNECT

Tool to build a Gateway for **Geothermal** community:
- Turn Open Science into practice
- It takes our open and linked research products
- It is a service customised to our need

What we need:
- **Set** the repository for the research products
- **Link** the research product to our community (e.g., in Deep Geothermal in Zenodo), funding and other research products
- **Custom** the portal interface

Repositories:
- Publication repos (OPENAIRE, OA Elsevier, ..)
- Project (OpenAIRE, Participant portal, ...)
- Data repos (Pangea, ...)

EGRISE version 2.0

OpenAIRE | **MONITOR**
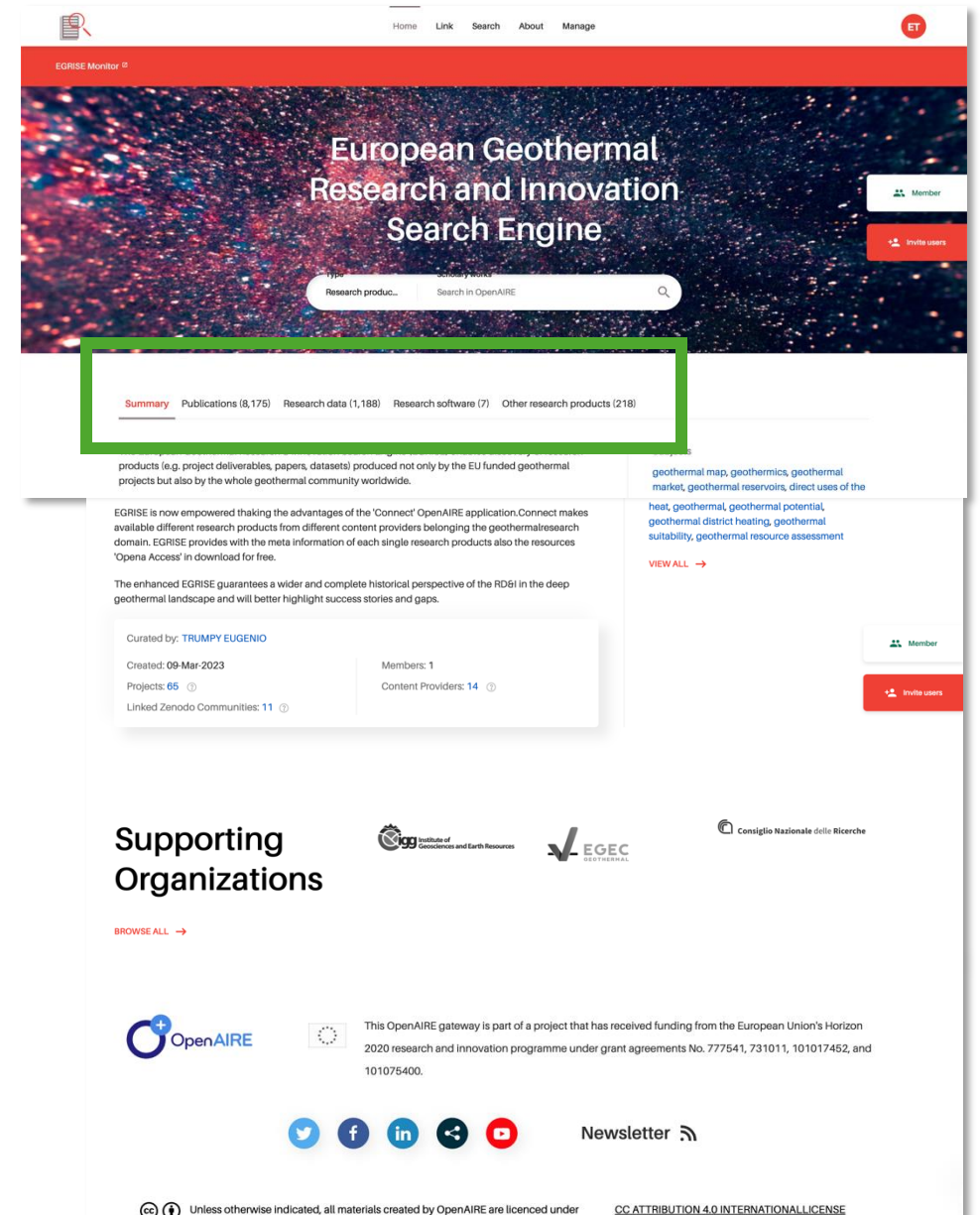
Tool to monitor research in **Geothermal**:

- Discover, track and understand <u>trends</u> and <u>impact</u> pathways, connections, collaborations for Geothermal (optimize the future)
- Make <u>informed decisions</u>
- Identify research pathways across key dimensions
- Discover (<u>Open Science</u>) research costs and trends
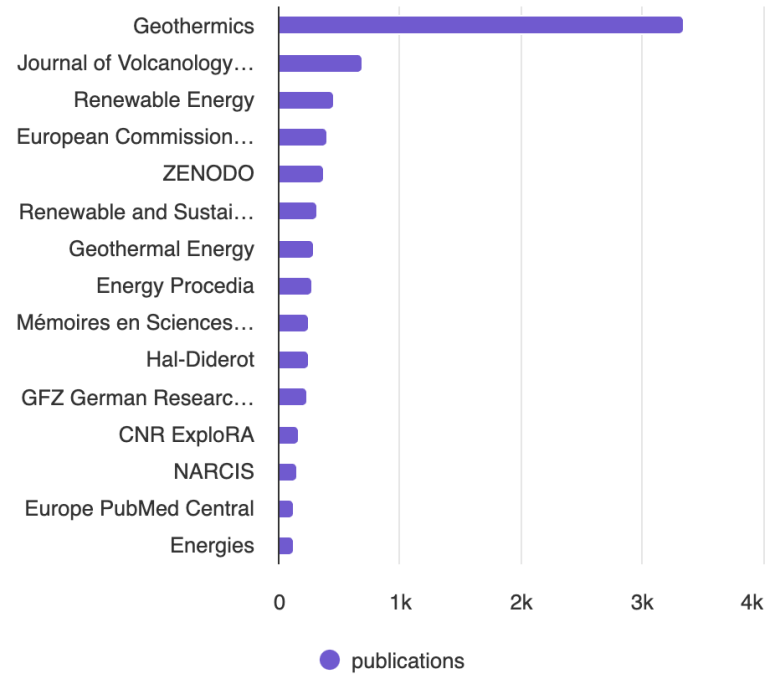- See what works and what not
- Reveal hidden potential

https://monitor.openaire.eu/dashboard/egrise/overview
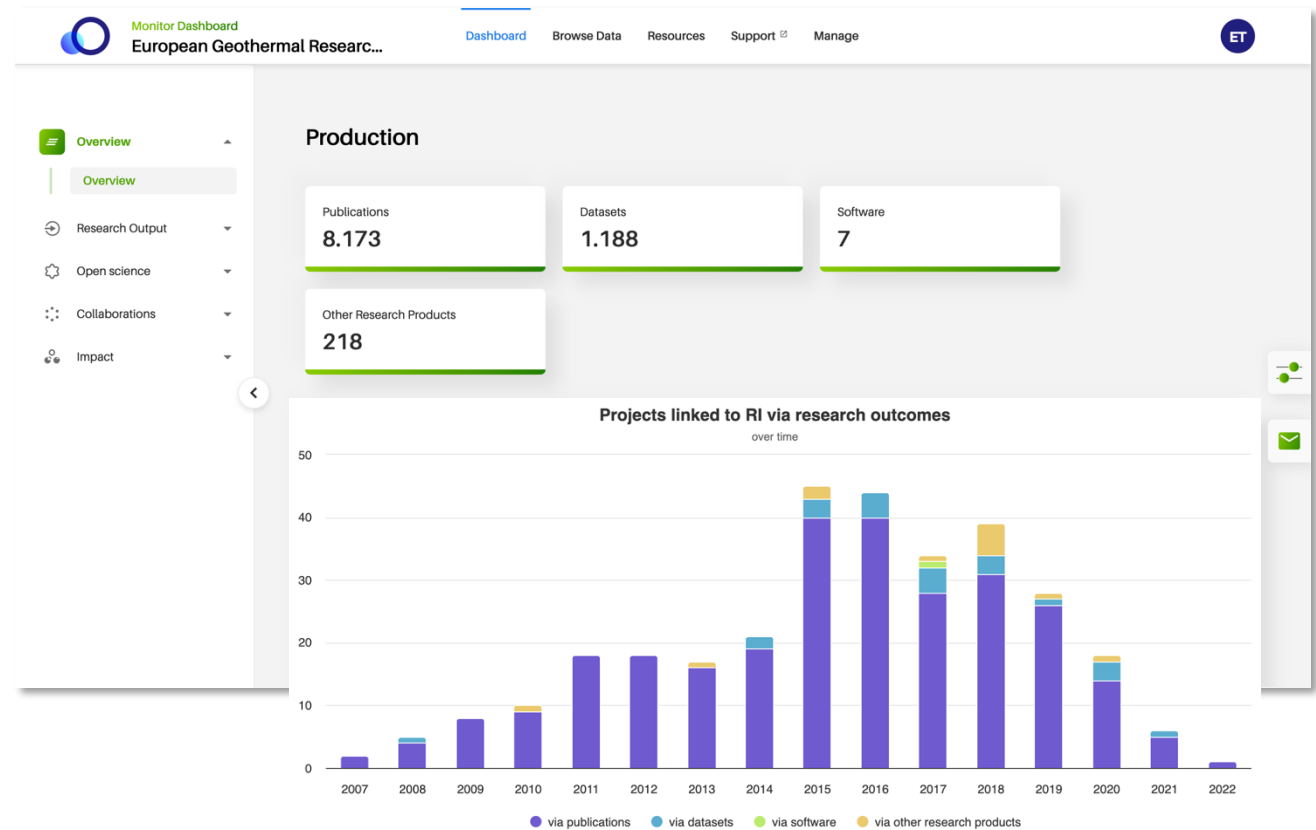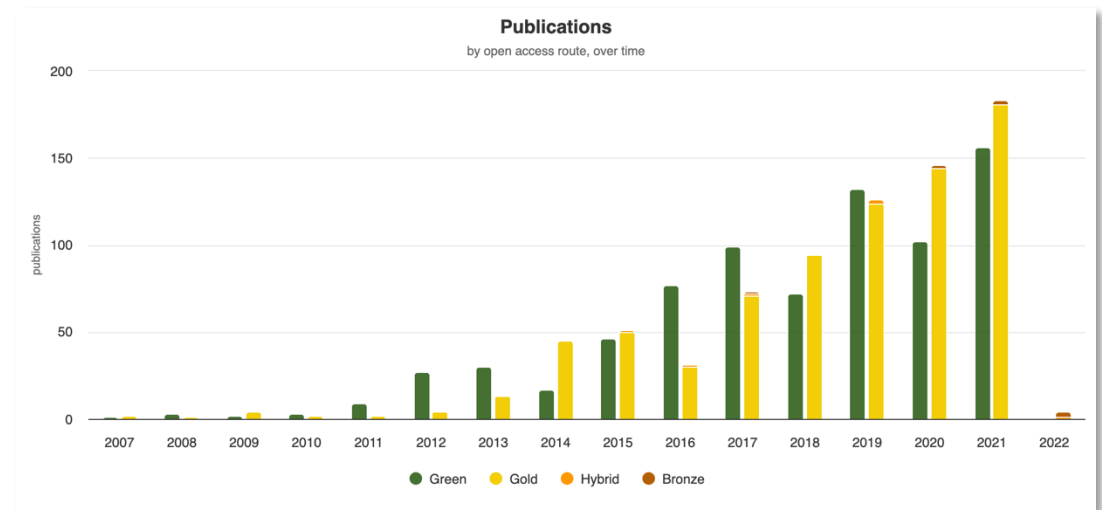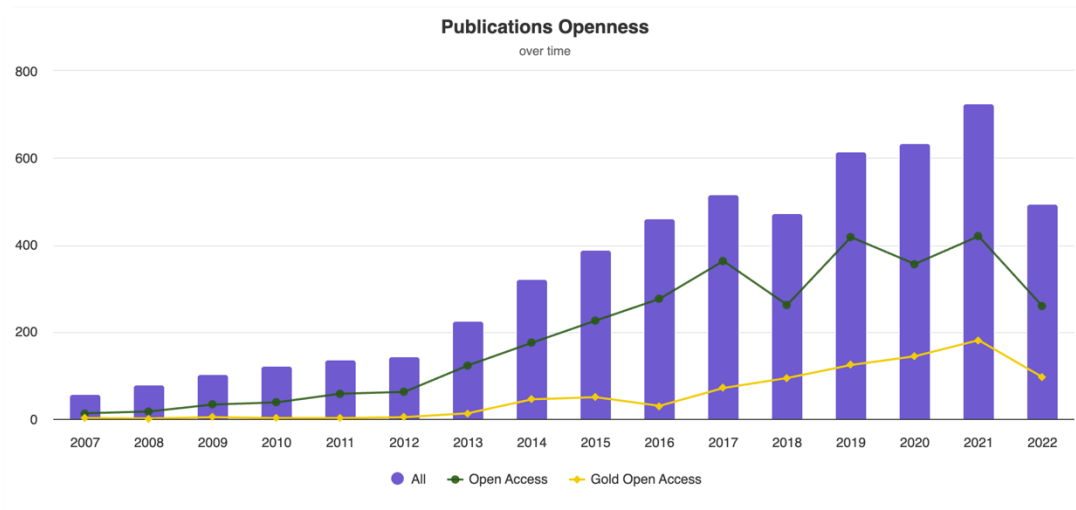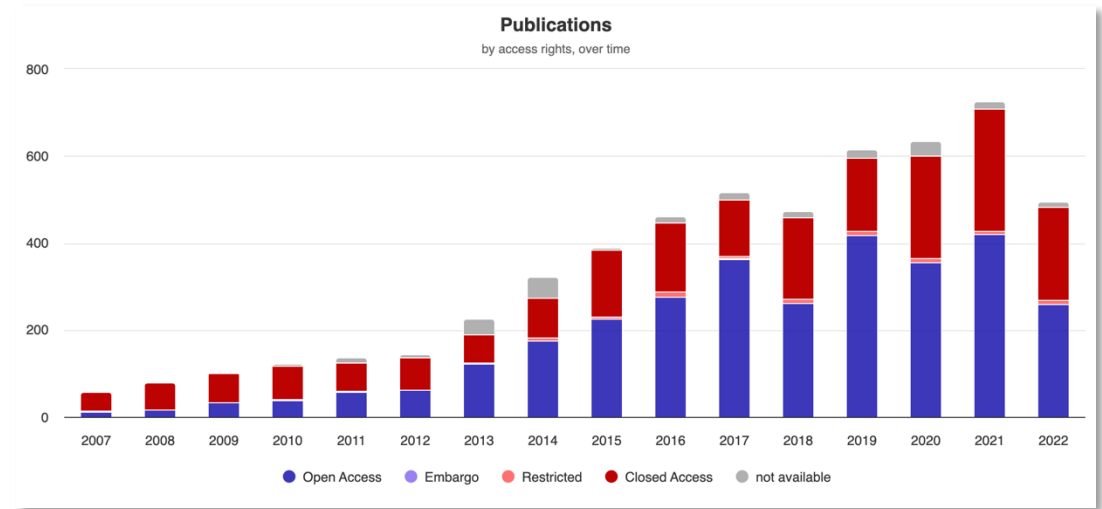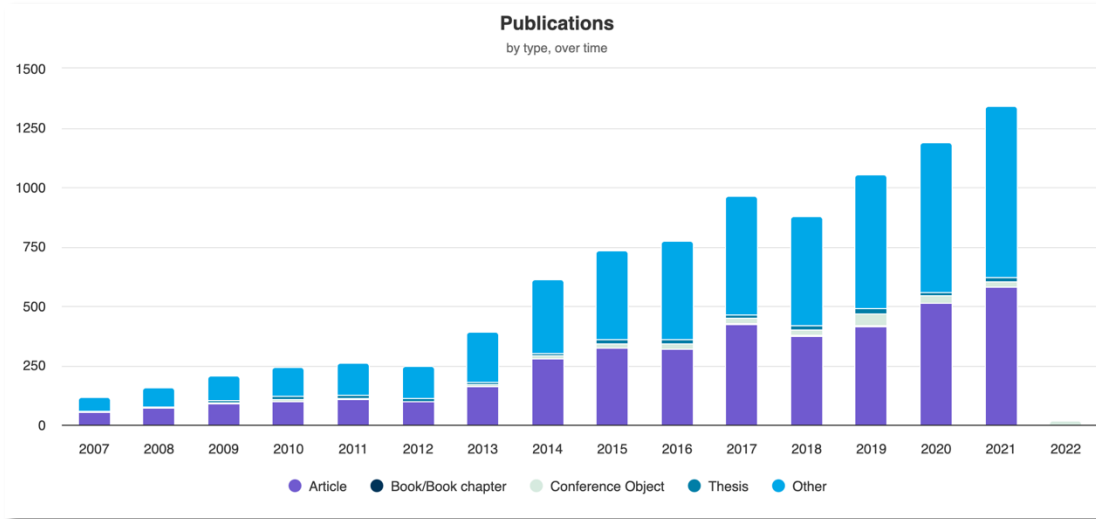
EGRISE version 2.0

EGRISE version 2.0

Top 15 Data Sources
by number of publications
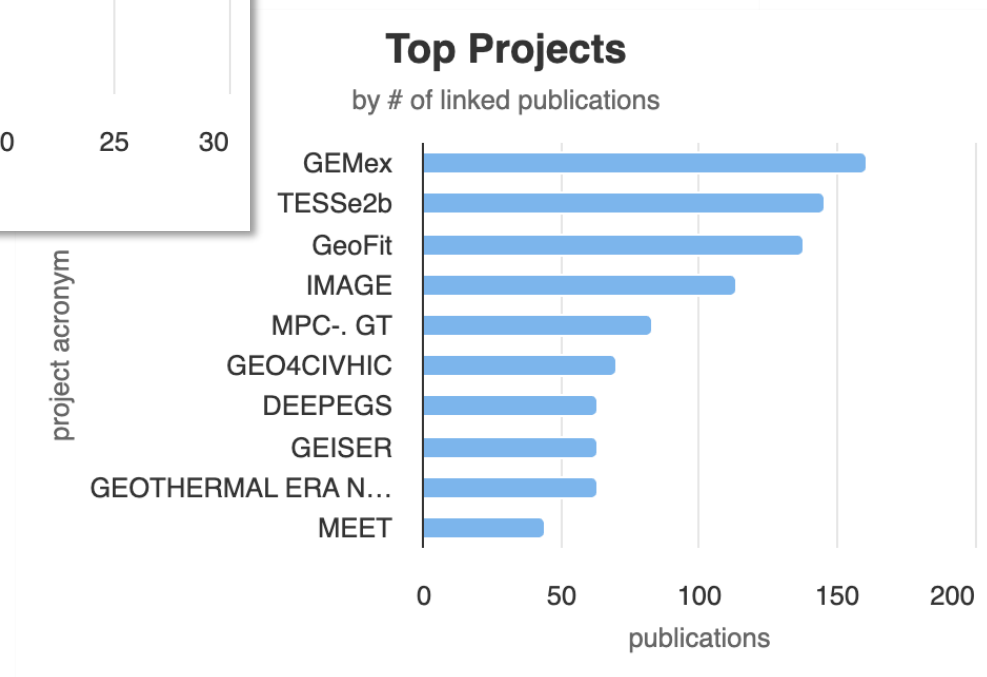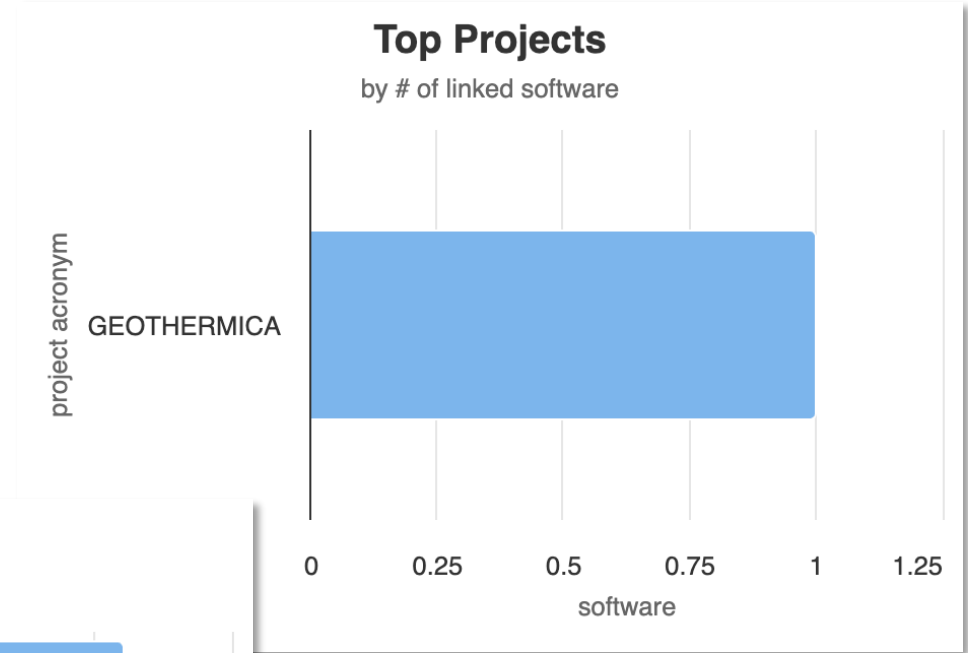
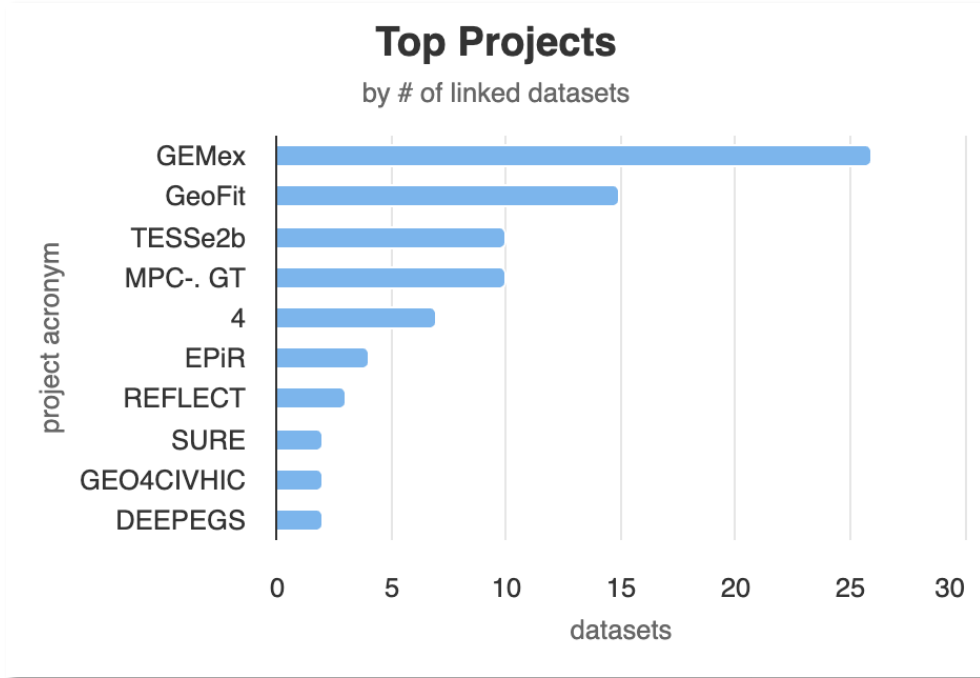**Top Journals**
by number of Gold OA publications
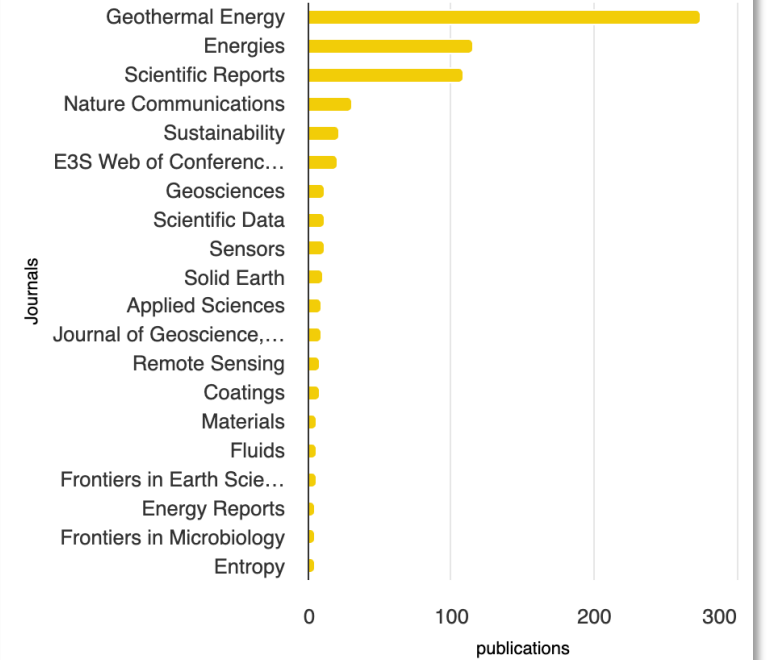
Top Organisations
by # research outcomes

EGRISE version 2.0

OpenAIRE | MONITOR

Top Projects
by # of linked datasets

GEMex, GeoFit, TESSe2b, MPC-. GT, 4, EPiR, REFLECT, SURE, GEO4CIVHIC, DEEPEGS — datasets (0–30)

Top Projects
by # of linked publications

GEMex, TESSe2b, GeoFit, IMAGE, MPC-. GT, GEO4CIVHIC, DEEPEGS, GEISER, GEOTHERMAL ERA N…, MEET — publications (0–200)

Top Projects
by # of linked software

GEOTHERMICA — software (0–1.25)

ITINERIS
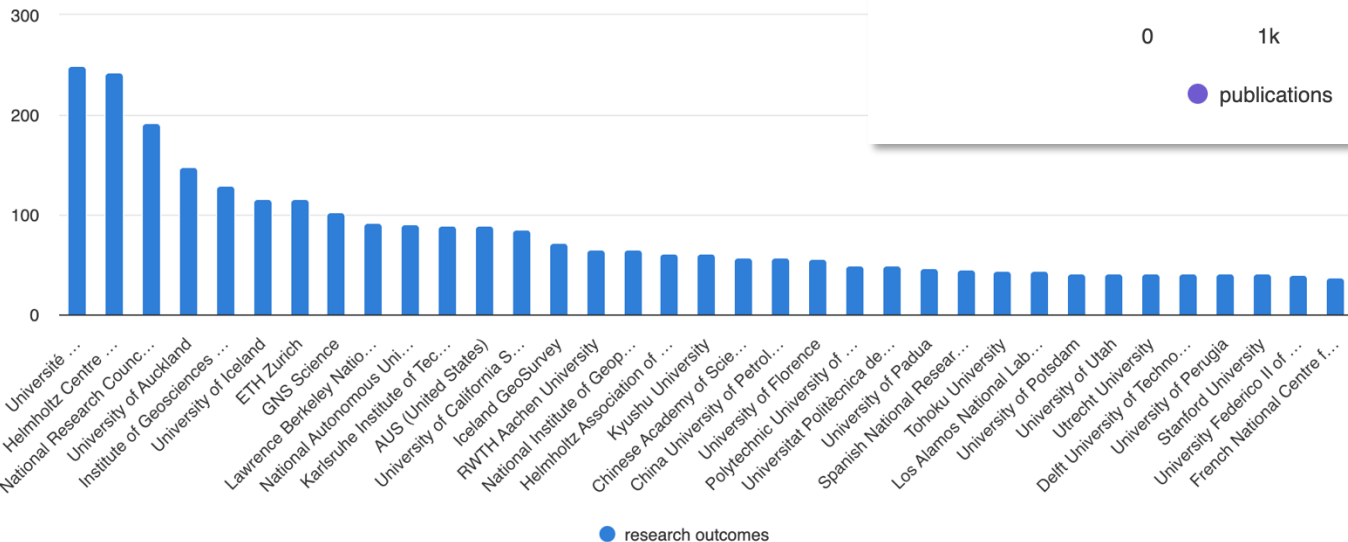
Virtual Research Environments and cross-disciplinary activities

- *Scopo:*
  - costruire l'Hub Italiano per l'accesso ai dati, ai servizi e alle facilities per lo studio interdisciplinare dei quattro domini ambientali del sistema Terra: atmosfera, idrosfera, biosfera terrestre e geosfera
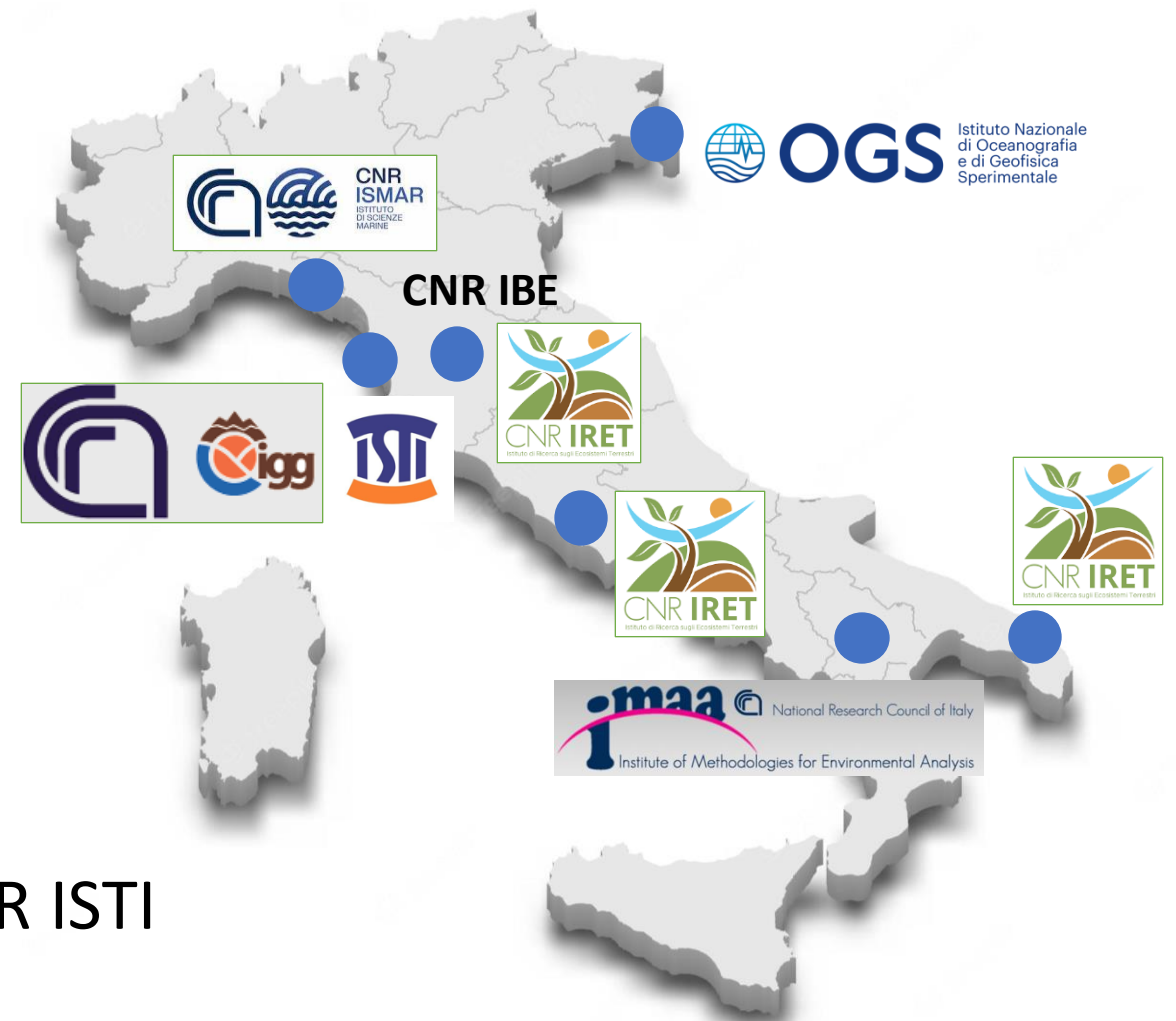

von Humboltd and Bonpland, Naturgemalde

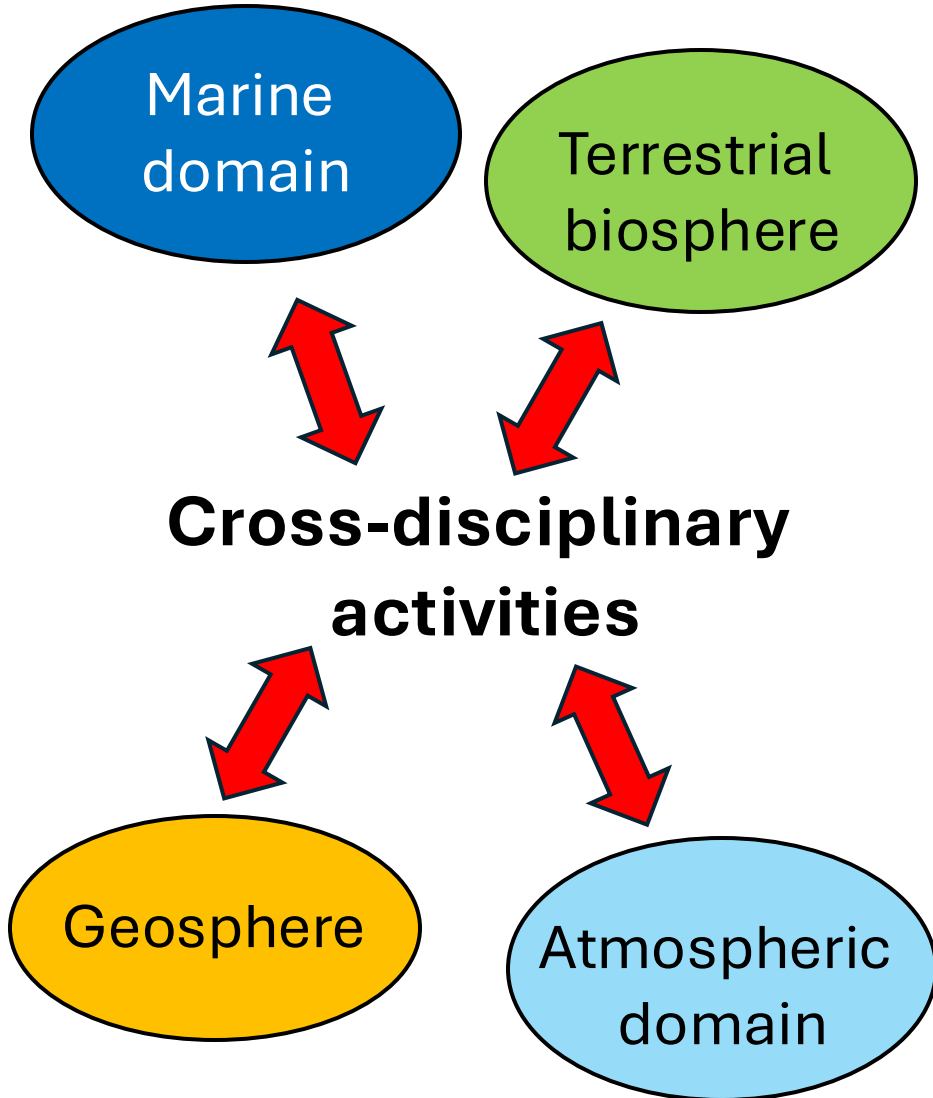# Main participating infrastructures

Main participating institutions

- CNR-IGG
- CNR-IRET-FI
- CNR-IRET-LE
- CNR-IRET-Montelibretti
- CNR-IBE-FI
- CNR-IMAA
- CNR-ISMAR-Lerici
- OGS-OCE Trieste

supporto tecnico-modellistico di CNR ISTI

Main project goals

Marine domain

Terrestrial biosphere

Cross-disciplinary activities

Geosphere

Atmospheric domain

The activities of WP8 use data, information and knowledge generated by the individual RI to create **a system of Virtual Research Environments (VRE)**, and provide **services where RIs from different domains are harmonized to deal with scientifically and societally relevant topics**.

This **systemic approach** will support the Italian role in several RIs and help taking a leading role to address complex, multi-disciplinary challenges.

The D4Science e-Infrastructure
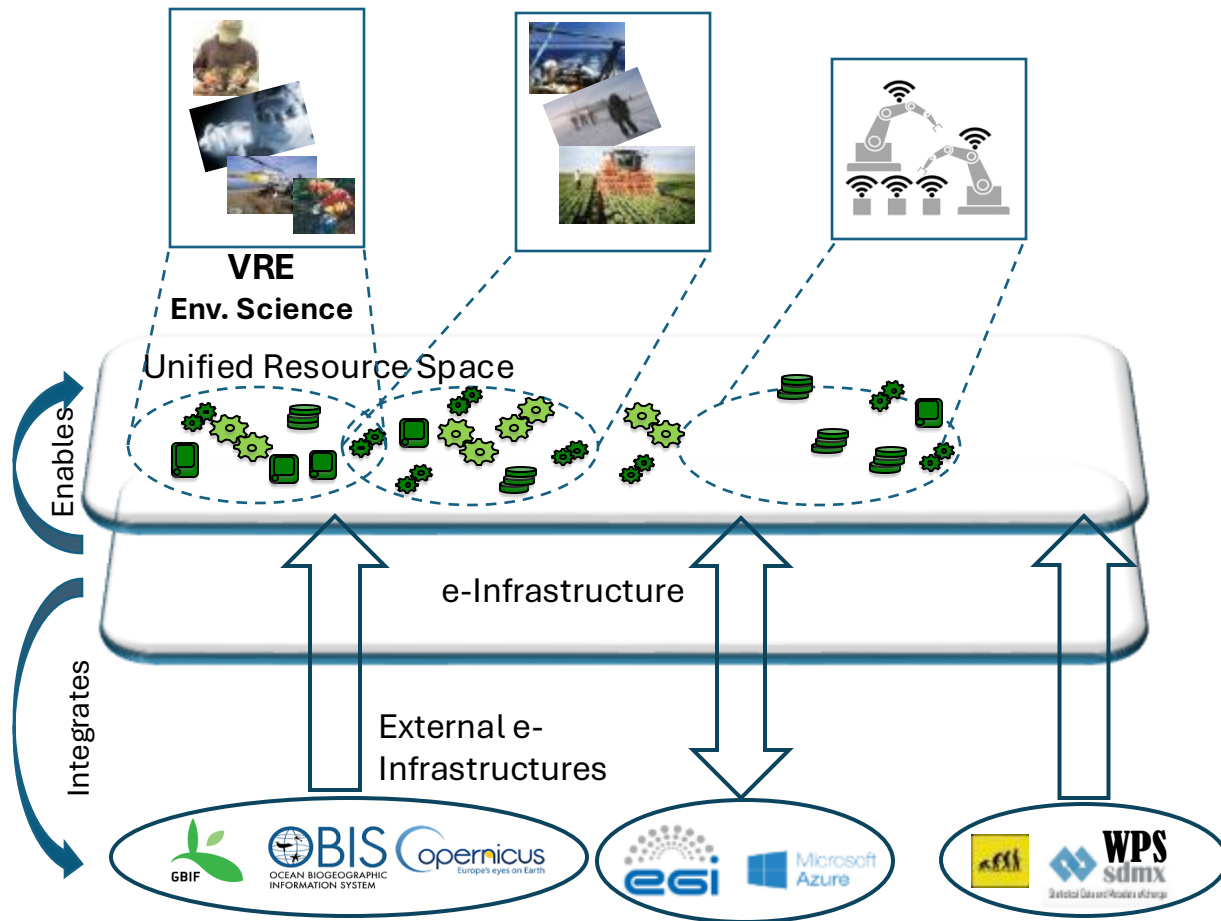
A **network** of hardware and software resources *(databases, processes, services, machines, AI models)* that **supports collaborative** and **data-intensive** Science:
- Enables collaboration between researchers across countries;
- Researchers work together having shared access to the same facilities (data, instruments, computing, and communication).

Supports the creation of **Virtual Research Environments** to:
- Define sub-communities of practice;
- Allow temporary dedicated assignment of computational, storage, and data resources;
- Manage heterogeneous data and processes access policies;
- Support data and information sharing;
- Allow sharing competences and creating multi-disciplinary applications.

VRE and Data workflow

- Collaborations and shared solutions **to answer specific scientific and/or management questions** that require an ensemble of data, analysis tools, modelling solutions and graphical tools, in the spirit of the open science principles.

- Researchers can upload/download and share knowledge, contributing to the construction of the VRE

- **Users** can access to a simplified version of the VRE to tackle specific issues

External repos

New knowledge

Data

VRE

Identification of gaps

Analisys tools

Graphical tools

Models
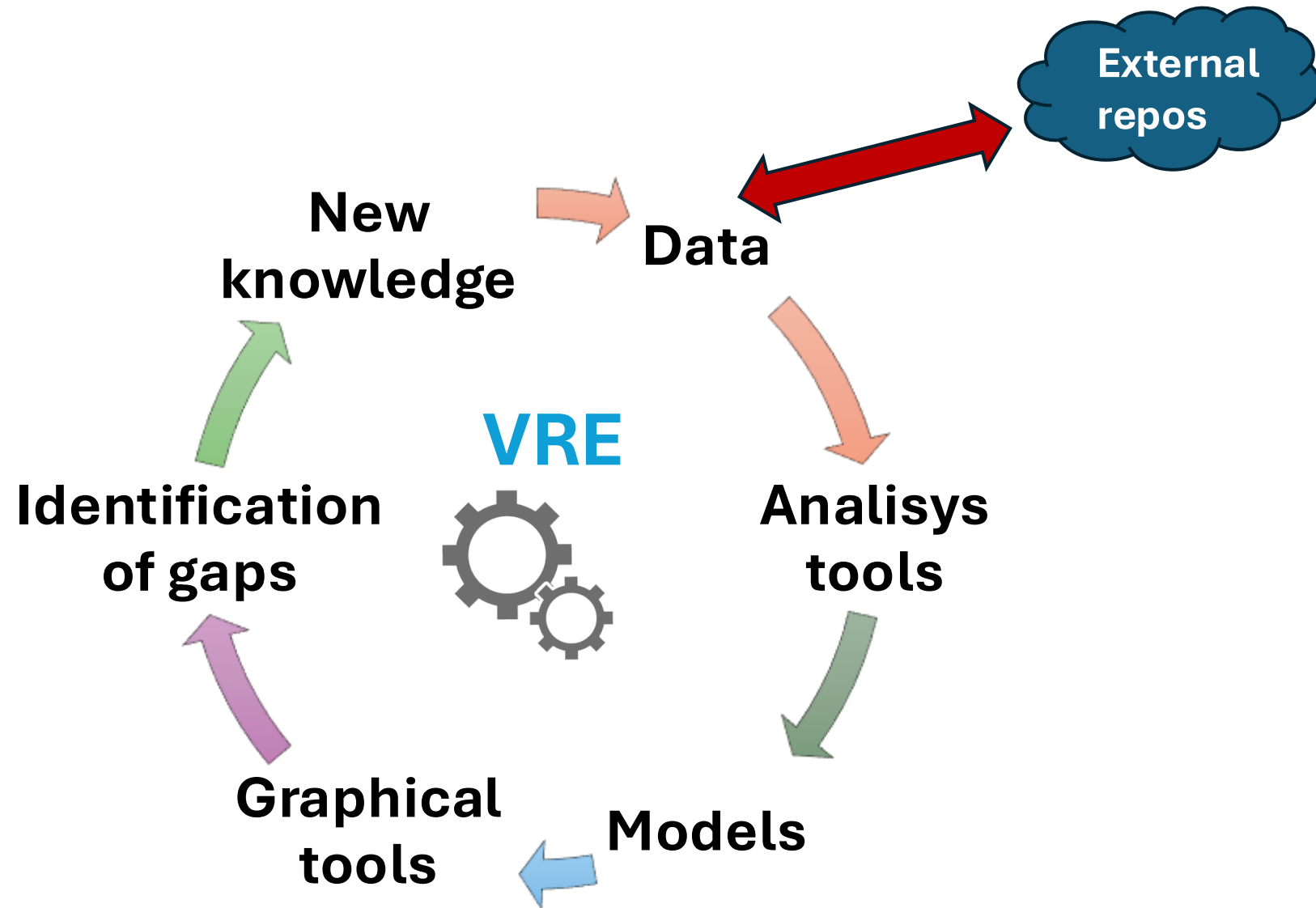
The ITINERIS D4Science Gateway: itineris.d4science.org

1. A gateway to the D4S-based VREs
2. Allows to request access to VREs
3. Allows to upload files on the VREs and to the private users' workspace

The Critical Zone (CZ) VRE


VRE manager: Pasquale Bove

- 28 members
- 149 datasets published in the catalogue
- 11 processes and models available
- Social networking facilities

Machine and service types available for each user:

- RStudio: 4 Cores / 8G RAM (at Isti-Cnr)
- RStudio: 8 Cores / 32G RAM (at Isti-Cnr and on the Garr network)
- RStudio: 8 Cores / 64G RAM (on the Google Cloud connected to D4S)
- Linux/Python/Julia/Notebooks: 4 Cores / 16G RAM (at Isti-Cnr)
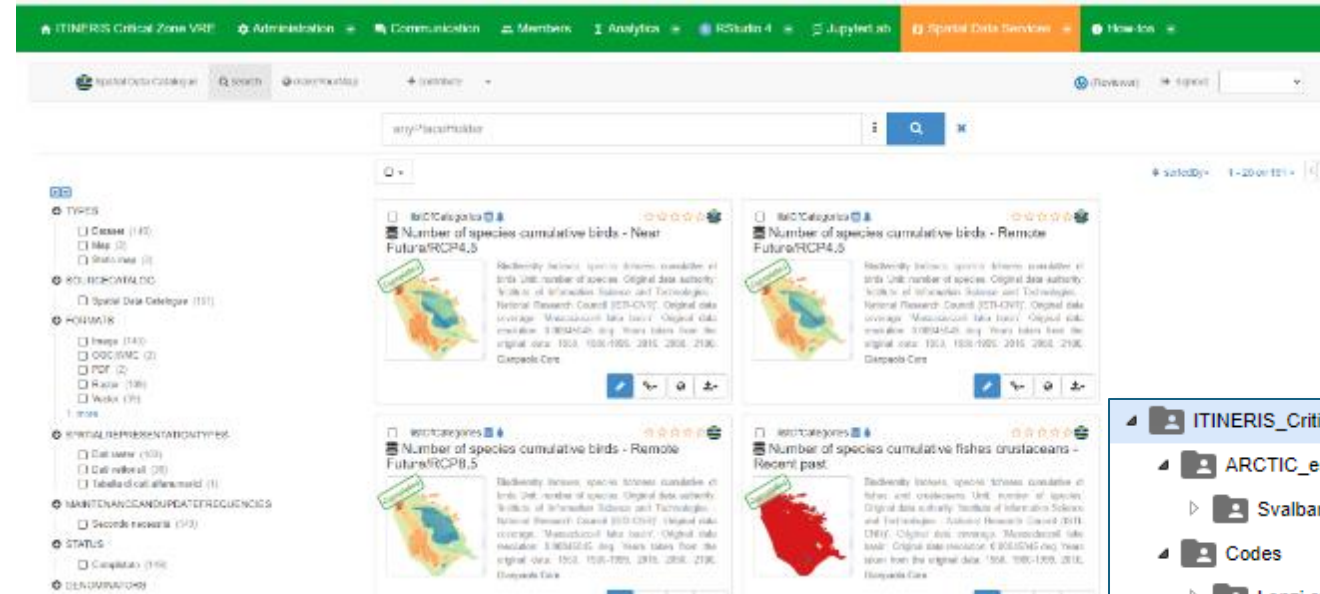
VRE Workspace organisation snapshot
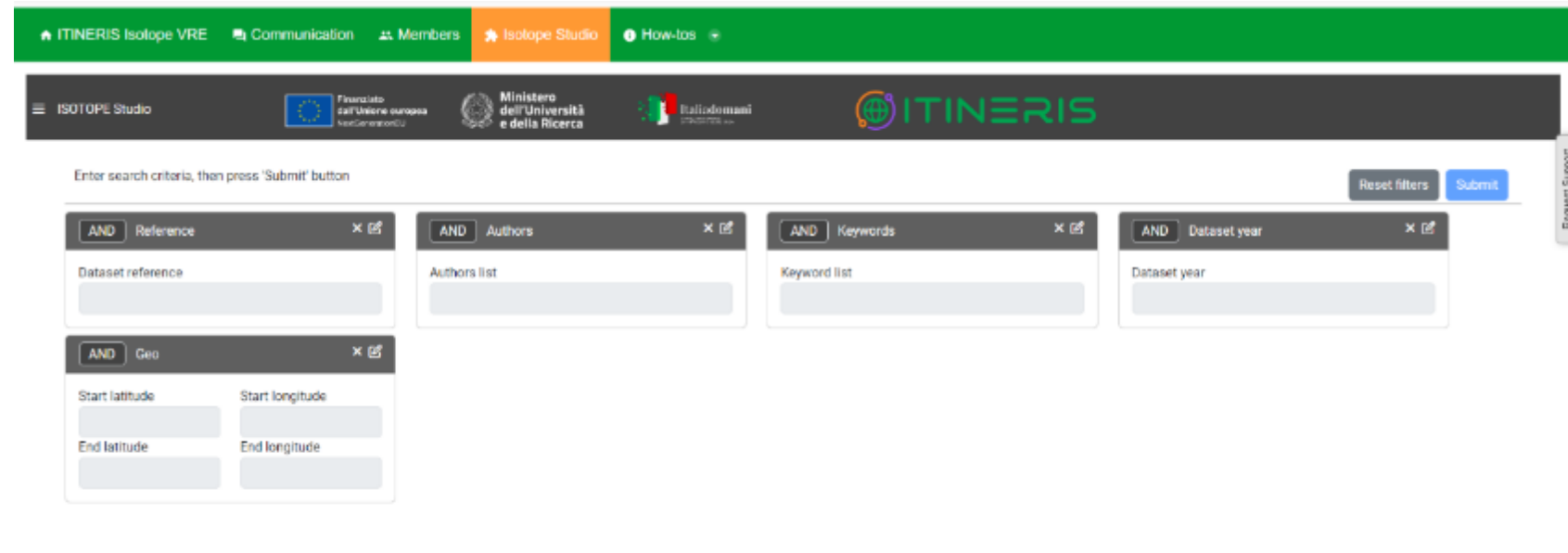containing data available for all VRE members
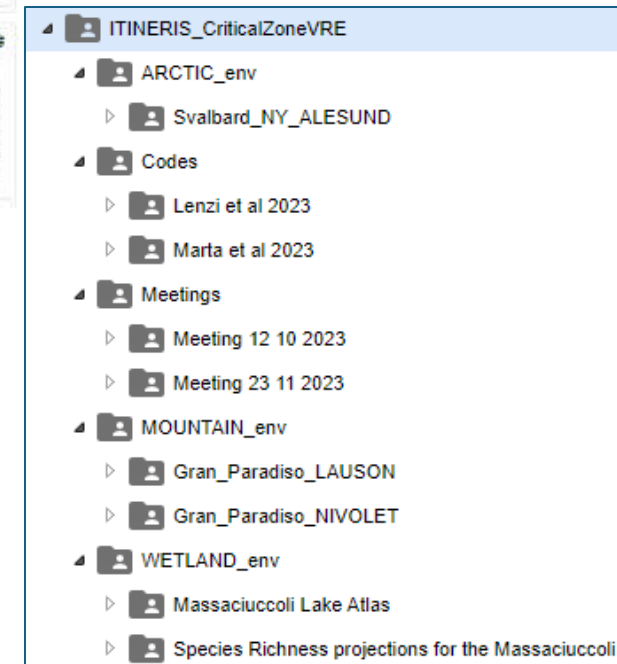
The Isotope VRE

VRE manager: Eugenio Trumpy

- 13 members
- Hosts the first-ever **full-suite for isotope data management, manipulation, harmonisation, and analysis**

- Uses machines with 8 Cores / 32G RAM hosted by Isti-Cnr and on the Garr network

VRE Workspace organisation snapshot
contains the docker image of the applications that all VRE members can download and use
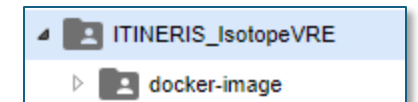
Conclusions

- Information, data, computing capabilities and services organised, shared and offered from a single easy to use platform

- Enable collaborations

- Find easily repositories

- Sharing research workflows

- FAIR metadata

- Sustainability?