European Strategy fo Research Infrastructures: CNRS-INSU perspective and messages

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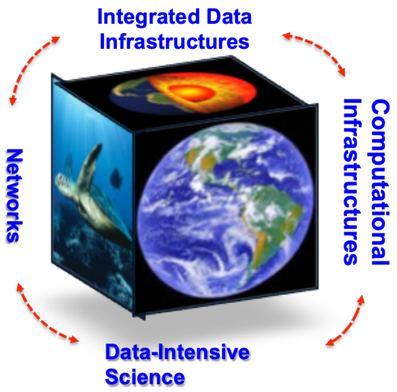
#ESFRroadmap2026

10 ans AERIS

Centre des congrès, Cité des sciences de Paris

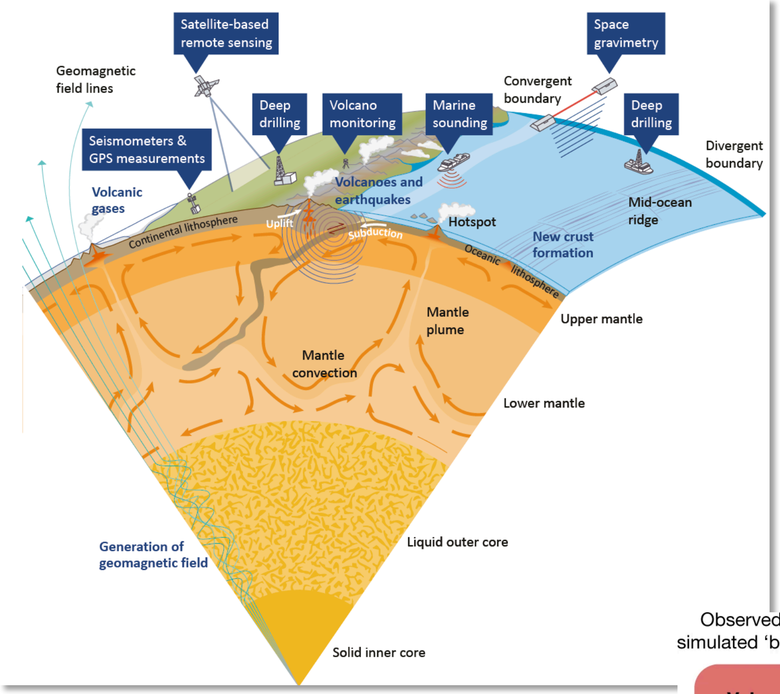
January 27-28, 2025

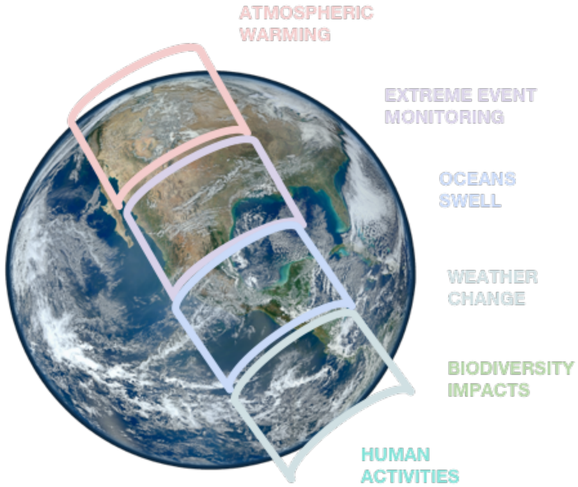


1 EARTH SYSTEM, CLIMATE & ENVIRONMENT: FROM OBSERVATION TO MODELS ADDRESSING RESEARCH AND SOCIETAL CHALLENGES

A complex dynamical system

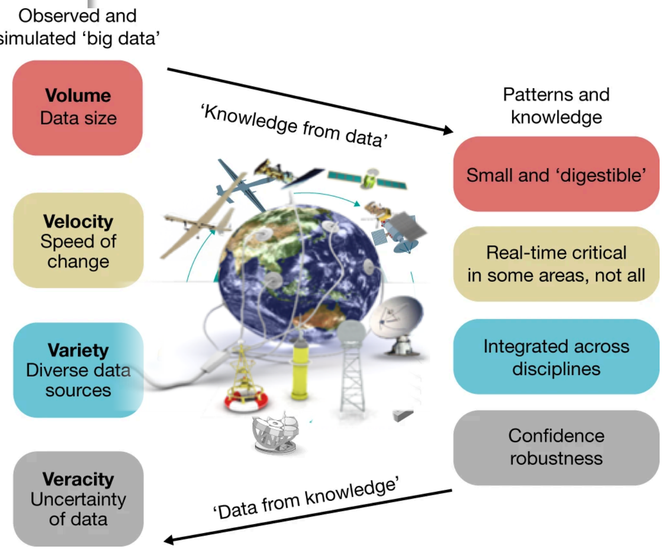
- Coupled geophysical, bio-chemical, biological and environmental processes
- Multiple mode of observing/measuring/simulating the wide range of spatial and temporal scale of the underlying systems
- Multi-scale interactions across the solid Earth, continental surfaces, and fluid envelopes (ocean, atmosphere), as with the anthroposphere.
- Regional and global dimensions: international collaborations and organisations





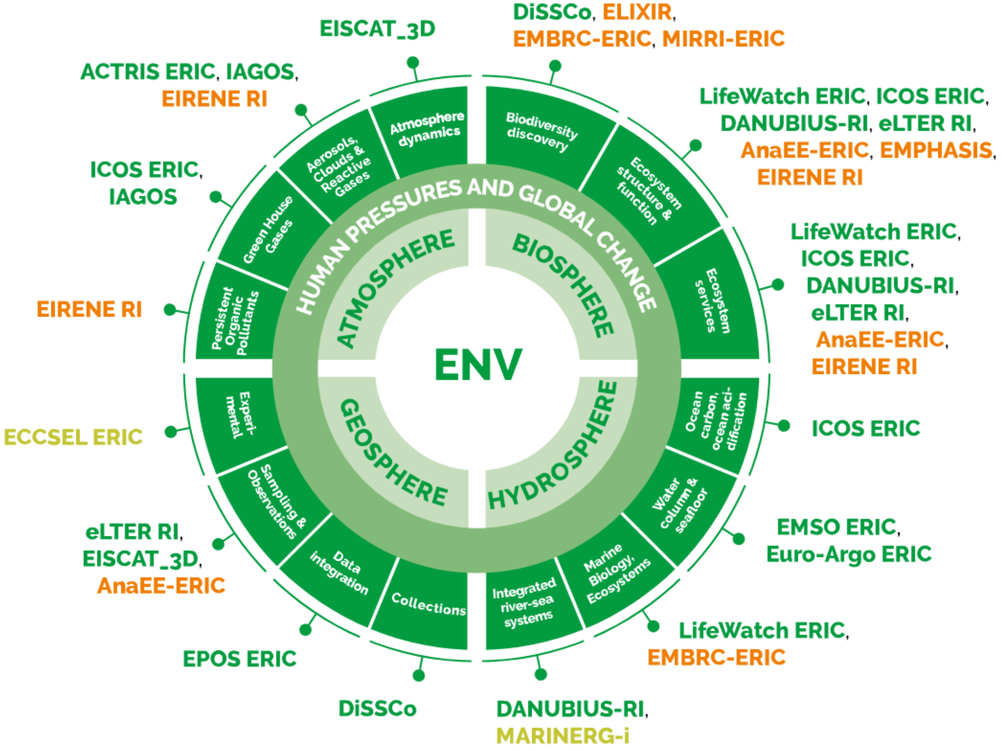
Science-driven issues

- Integrated approaches to complexity and uncertainty quantification
- Long-term sustainable management of high-quality, trusted multi-domain open data (integrity, veracity, interoperability)
- Discover & access services and cross-analysis workflows of multi-source (spatial airborne, in-situ, simulation, experiments) and multi-modal observation/simulation data
- Open AI-coupled HPC/HPDA workflows to extract from multi-modal data and to represent information in shared embedding space (homogenisation/unification)
- Open AI-based multi-modal foundation models for science: knowledge-based learned values evaluation and certification



Scientists and decision makers need an **integrated interdisciplinary approach and expertise** with trusted multi-domain data and services

2 NATIONAL & EUROPEAN RESEARCH INFRASTRUCTURES



Landscape of the Environment domain (ESFRIO Landscape Analysis 2024)

National Roadmap: last update 2021

- 108 ***Research Infrastructures*** (**RIs**) in 2021
- 5 ***International Scientific Organisations*** (**IOs**): ESO, ESA, SKAO, EMBL, CERN, CEPMMT
- 23 RI*, 73 RI, 7 projects with strategic potential
- 10 Thematics: Astronomy & Astrophysics, Biology & Health, Energy, Nuclear and High-Energy, Physics, SHS, Material Science and Enginery Physics, Numerical Science and Mathematics, Earth System and Environment, Digital Services (Compute & network), Scientific Information
- ***Aligned with the European ESFRI Roadmap***: France contribute to 37 of 41 ESFRIs

European Research Area in 2024

- Pan-European RIs - **ESFRI** Roadmap incubator of a new legal framework (**ERIC**) as support for implementation
- **Europeans RI networks** - set-up through past EU research programs (joint research activities, access provision) open up national RIs promoting common access programs
- H2020 - ***90 networks***, 37,000 researchers supported, open to international members and users
- ***National Facilities and labs*** - large and small scale roadmaps (alignment of methodologies and priorities), often nodes of European RIs, national + European funding (capacity building)
- ESFRI landmarks label awarded to around 40 RIs (e.g., ESRF, ILL, EMBL, IRAM, National Large Heavy Ion accelerator, Apollon Laser, GENCI)

Infrastructures are an essential pillar of Europe's research strategy

ESFRI ROADMAP CYCLES: OVERVIEW

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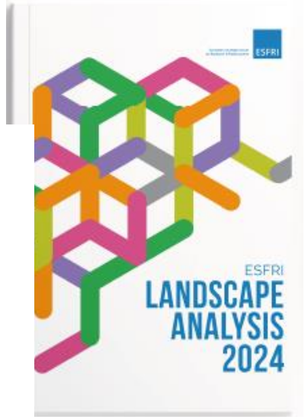
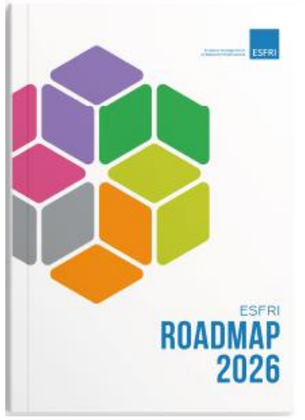




1st ESFRI Roadmap cycle (2006)

- Updated in 2008 and 2010: 48 projects across a broad range of scientific fields
- Required major financial investment (~20 b€) and long-term commitment for operation (2b€/year)

2nd ESFRI Roadmap cycle (2016-2024)

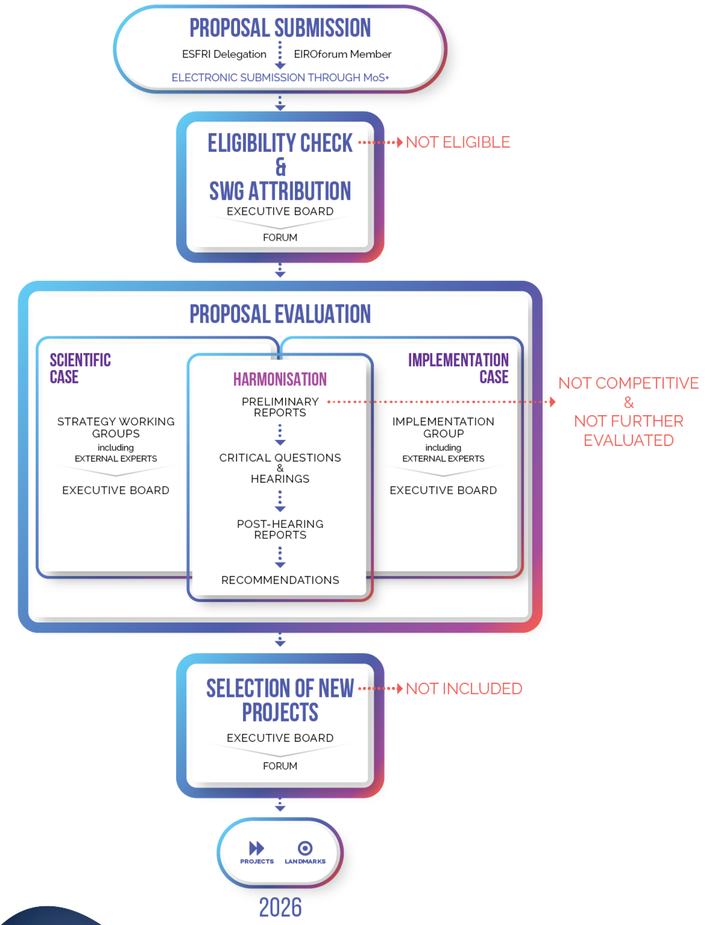
- RI lifecycle concept, comprehensive evaluation methodology, introduction of the Landmarks
- ESFRI Roadmap 2016, 2018 and 2021: Strategy Report + 41 ESFRI Landmarks + 22 ESFRI projects
- RI Landscape Analysis (2024) decoupled from the Roadmap: rationale for ESFRI Roadmap 2026
- First version of the ESFRI RIs Portfolio
- RI investment agenda (~25b€)

3rd ESFRI Roadmap cycle (2026)

- Evaluate new pan-European RI projects
- Monitor all projects 2016, 2018 and 2021
- Assessment of Projects 2016 vs Landmark status
- Update the ESFRI portfolio
- **Synergies with regional, *national*, European and International RIs**
- **Links between and integration of RIs**
- **E-Infrastructure needs and data and use of new digital tools such as AI**
- ***Links to the EOSC ecosystem + role of open science***
- **Environmental considerations**

4 ESFRI ROADMAP 2026 PLANING

Submission & Evaluation new proposals



SCIENTIFIC CASE

Six reference scientific domains represented by the following SWGs:
ENE SWG - ENERGY
ENV SWG - ENVIRONMENT
H&F SWG – Health & Food
PSE SWG – PHYSICAL SCIENCES & ENGINEERING
SSH SWG – SOCIAL SCIENCE AND HUMANITIES
DIGIT SWG – DATA, COMPUTING AND DIGITAL RESEARCH INFRASTRUCTURES

The SWGs evaluate the SCIENTIFIC CASE along six dimensions:
- scientific excellence
- pan-European relevance
- socio-economic impact
- user strategy and access policy
- e-needs & data
- environmental considerations

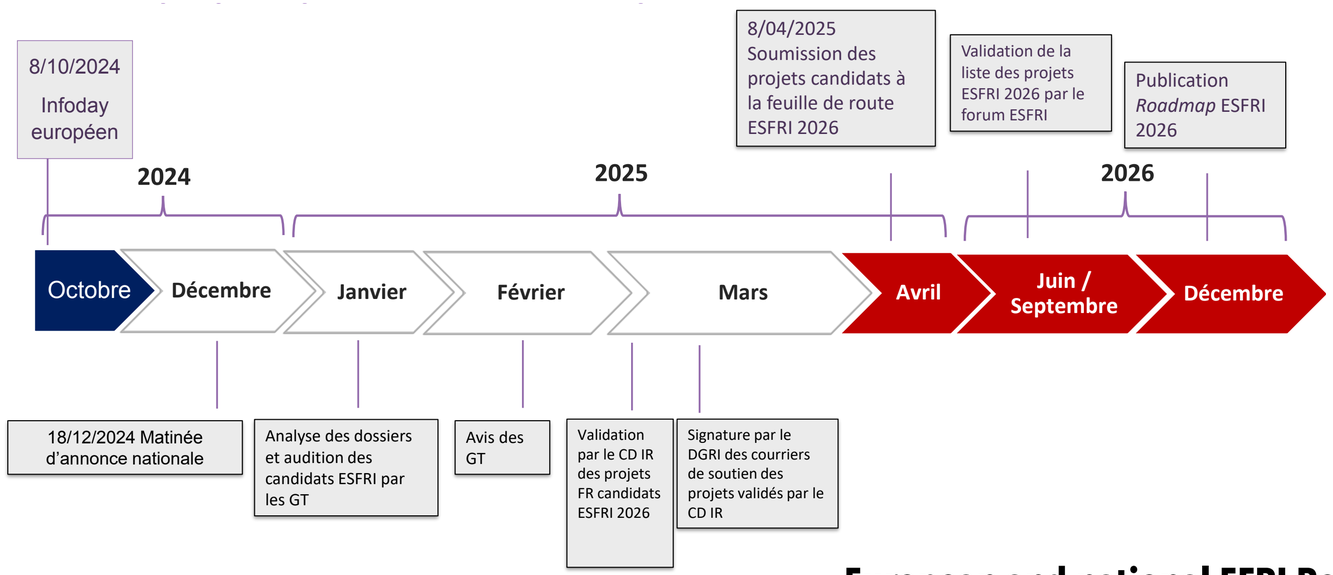
When evaluating the SCIENTIFIC CASE, the SWGs take the dimensions of the IMPLEMENTATION CASE into account.

IMPLEMENTATION CASE

The Implementation Group (IG) evaluates the IMPLEMENTATION CASE along five dimensions:
- stakeholder commitment
- preparatory work and planning
- governance, management & human resources
- finances
- Risks

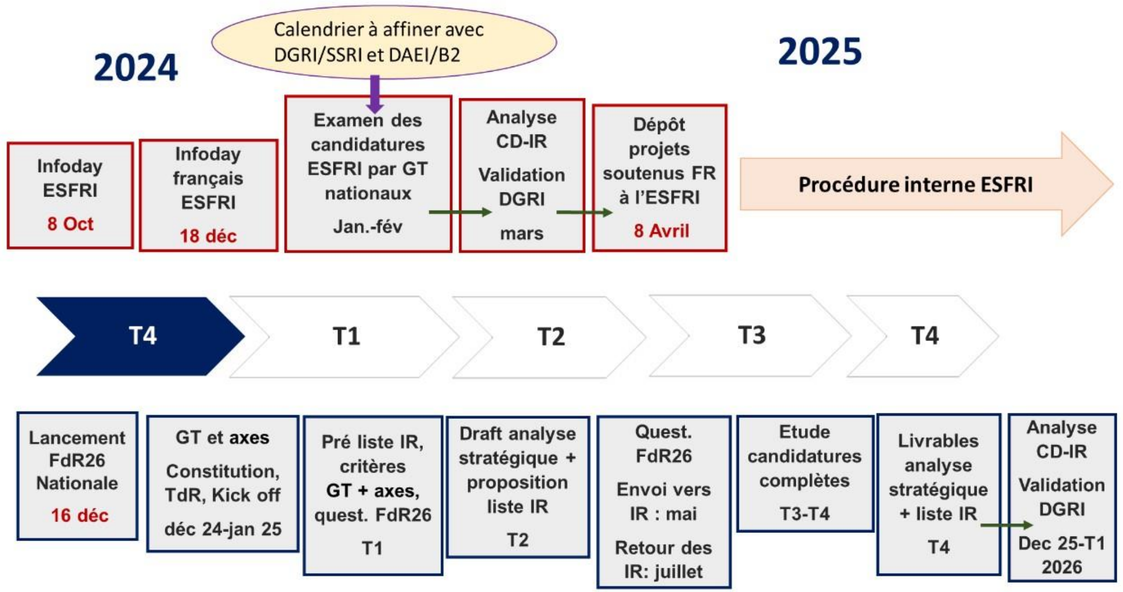
When evaluating the IMPLEMENTATION CASE , the IG takes the dimensions of the SCIENTIFIC CASE into account.

ESFRI Strategy Report on Research Infrastructures ROADMAP 2026



European and national EFRI Roadmap 2026 planing

5 FRENCH ESFRI ROADMAP 2026 PLANING



Forum ESFRI delegates

- Elena Hoffert, DAEI B2: *Vice chair* and member of the executive board
- Jean-Marie Flaud, DGRI SSRI A1: member of the monitoring committee

Members of the Scientific Groups (strategic working groups, SWG)

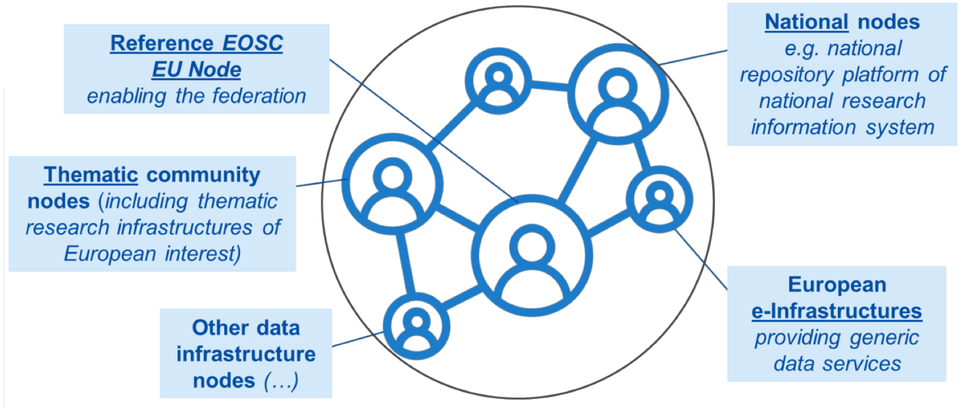
- Jean-Marie Flaud, DGRI SSRI A1: SWG Environment
- Catherine Le Chalony, DGRI SSRI A4: SWG Health & Food
- Francis Bloch, DGRI SSRI A5: SWG Social Sciences and Humanities
- Xavier Montagne, DGRI SSRI A2: SWG Energy
- Jean-Luc Biarrotte, DGRI SSRI A2: SWG Physical Sciences and Engineering

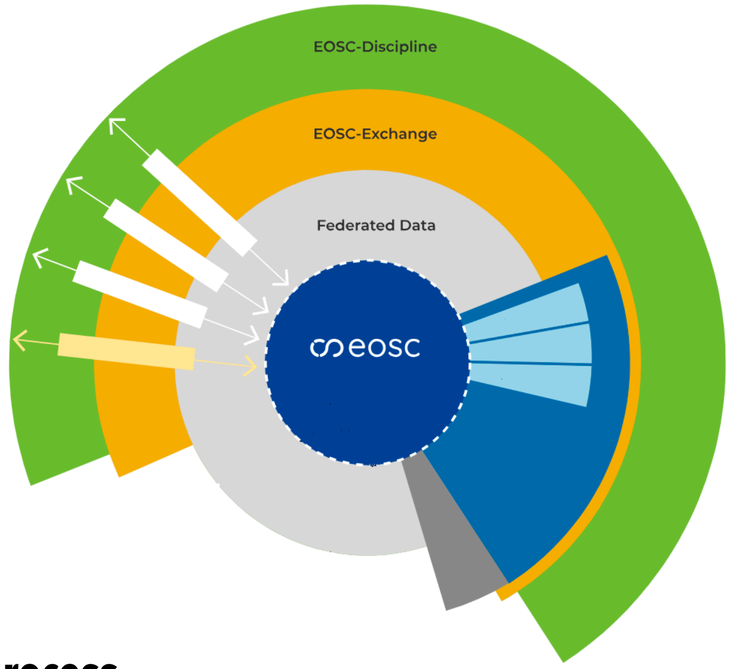
CNRS actors

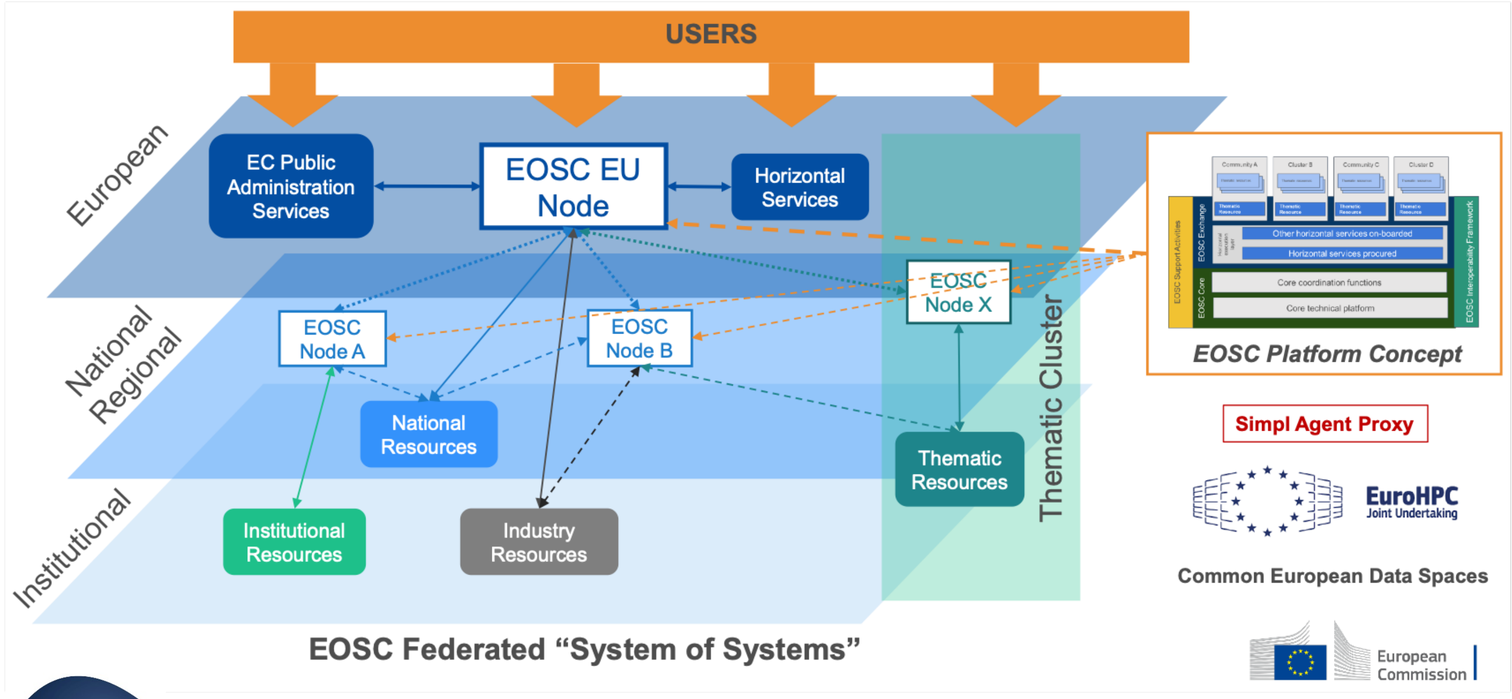
- Cellule TGIR: M. Guidal, G. Ohanessian, S. Le Van, A. C Eric, M. Stephanus
- TGIR committee: Cellule TGIR + DAS Infrastructures (INSU: J. Rose) + representants DEI, DDOR, DAJ, DS DD, GTM "Infras" + DGDS (A. Schuhl) + DIs (INSU: N. Arnaud)

Stratégie Nationale des Infrastructures de Recherche

6 EOSC EU FEDERATION







A process

- Accelerate Open Science, FAIR data management and use of digital methods and services
- Stimulate multi-disciplinary science and research, higher research productivity, and improved reproducibility in science

An Open, trusted federation of infrastructures

- Access to existing Research Infrastructures in Europe
- Enable researchers to store, share, analyse and reuse research digital objects

An evolving and scalable ecosystem

- Bring together the European commission, the governments and the many RI stakeholders
- Co-create across European, national and institutional levels

7 EOSC EU NODE GATEWAY

[European Open science Cloud Node]

Authentication, Authorisation, Accounting (AAA)

- eduGAIN and EU Login (with eIDAS) integration
- Policy-based Access Control (PBAC) retrieving use attributes from home IdP
- Virtual credits and Wallets (personal, group)

Contributor tiers (discoverable, onboarded, native)

- Resource Hub collecting research objects from OpenAIRE, CORDIS, data.europa.eu, Software Heritage, …
- Curation service for resource object owners
- Persistent Identifiers

Data transfers

- Bulk data transfers: orchestrate and monitor transfer of large data sets; easy and simple authentication; automation and integration with third-party software via FTS RESTful API
- Large file transfers: efficient multiple file transfer management and performance optimisation

Integrated User Space with automated deployment workflows

- Virtual Machines: templates with pre-installed software and configuration for different research domains; VM snapshots and monitoring tools
- Cloud container platform: orchestrated and managed containers with load balancing; facilitated secure workflows with CI/CD pipelines and automated HTTPS certificates
- Interactive notebooks: Jupiter Hub, persistent storage and synchronised with File Sync & Share own Cloud
- File Share & Sync across locations and groups

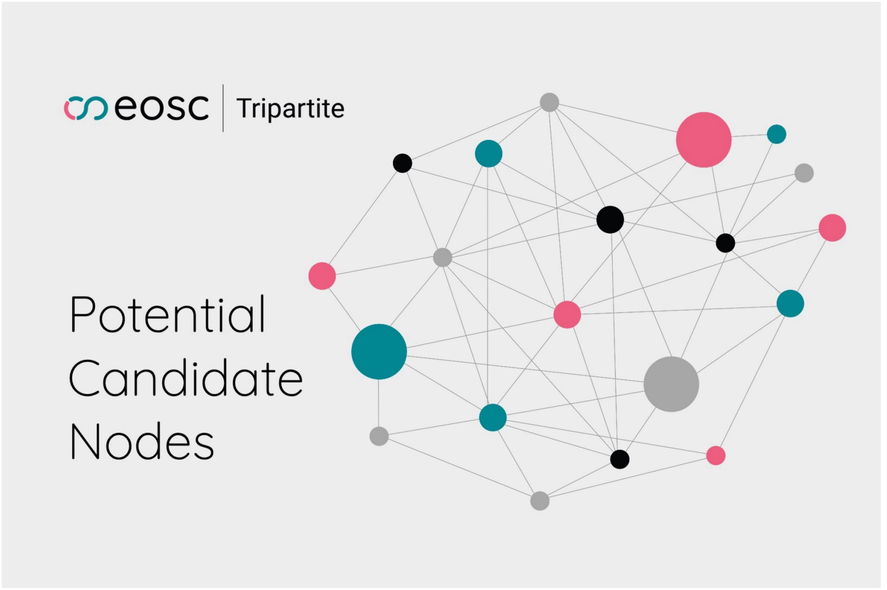
Monitoring and Helpdesk

- Availability dashboard and support for end-users

9 CONTRIBUTING TO THE EOSC FEDERATION BUILD-UP PHASE

A two-stage dialogue process to enable the EOSC Tripartite Governance to select a first wave of candidate nodes by February 2025:

- 29 Potential Candidate Nodes (PCN) selected: Data Terra as a national thematic node
- First-stage dialogue meetings December 2025 + Online questionnaire January 2025
- Second-stage dialogue meetings: 13 PCNs (February 2025)
- **Data Terra selected for the second stage dialogue**



First-stage dialogue Meeting 1	First-stage dialogue Meeting 2	First-stage dialogue Meeting 3	First-stage dialogue Meeting 4
ACTRIS ERIC	BITP	ACOnet / EOSC Support Office Austria	BBMRI ERIC
ARIADNE RI	**CNRS (Data Terra)**	ARNES	Elixir Hub
CERN	CVTI SR	CSC – IT Centre for Science	EMBL
CLARIN ERIC	Foundation ICSC	DeiC	Euro-BioImaging ERIC
CNR (Blue-Cloud)	HUN REN	EUDAT	Instruct ERIC
CNRS-LAPP (ESCAPE)	Lux NDS	NRIS	
ESRF (PaNOSC)	NCN	SND	
	NFDI	SRCE	
		SURF	

10 THE NATIONAL DATA TERRA E-INFRASTRUCTURE

Key Figures:
50 M€/year + external resources
34 Research Organisations and Universities
30 Observation Data and Services Centres (CDOS)
32 Consortium of Scientific Expertise (CES)
450 scientists, engineers and technicians

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Liberté
Égalité
Fraternité

DATA TERRA

National **E-infrastructure** for the **Earth system science**, Climate, Environment and Biodiversity of the French national **RIs road-map** receiving long-term support from the French Ministry of Research and 34 Research organisations.
D-T provide access and treatments to multi-source and multi-component FAIR data and services. It is organised into thematic Data Hubs, also deploying national instances serving the implementation of RIs at the European level.

- AERIS — **Atmosphere**
- FORMATER — **Solid Earth**
- ODATIS — **Marine Environment**
- PNDB (Pôle National de Données de Biodiversité) — **Biodiversity**
- Theia — **Earth Surfaces**

EOSC Node Legal entity:

cnrs

MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR, DE LA RECHERCHE ET DE L'INNOVATION
Liberté
Égalité
Fraternité

Supported by:

cnes · Ifremer · INRAE · METEO FRANCE · IRD · brgm · cea · IGN

DATATERRA INTER-PÔLES
Sharing expertise for **FAIR data** and services

DATATERRA DINAMIS
VHR **satellite imagery**

Copernicus

ACTRIS-FR · ICOS-FR · IAGOS-FR · EPOS-FR · Euro-ARGO · ILICO-JERICO · EMSO-FR · ANAEE-FR · in-SYLVA-FR · eLTER-FR

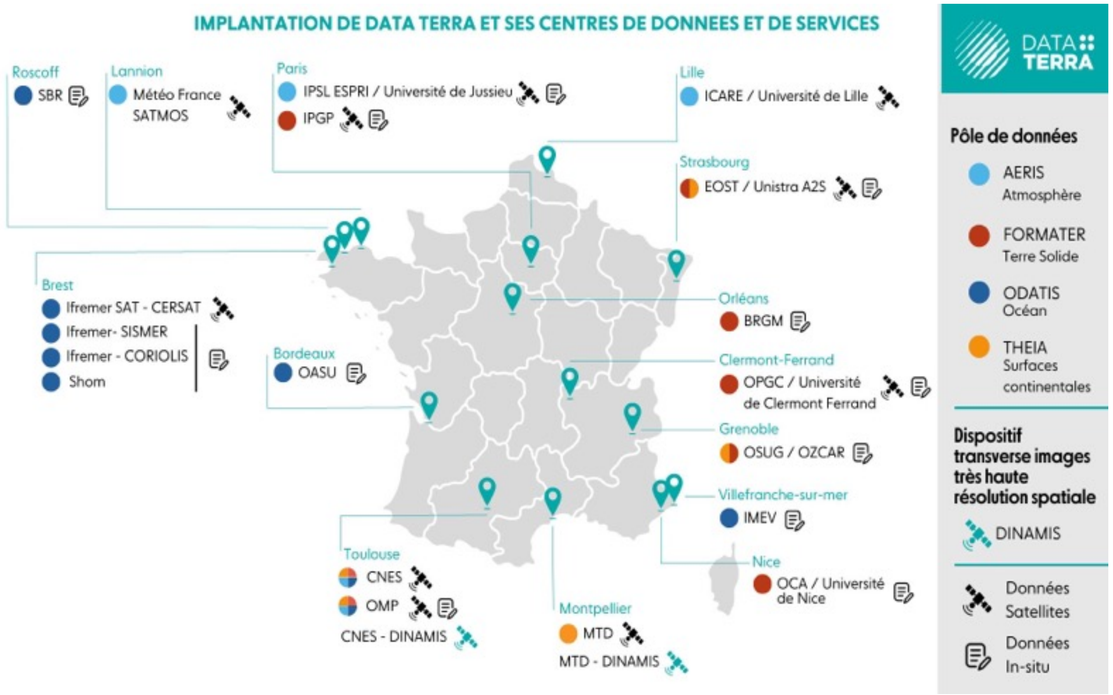
ESFRI

- ✓ Reference backbone data services in major national research projects;
- ✓ Based on nationally labelled services distributed on the French territories;
- ✓ National thematic reference centre for Earth System, Environment and biodiversity data;
- ✓ Involved in several EU EOSC-related project (coordinator and partner).

DATA TERRA: SOVEREIGN PUBLIC RESEARCH DATA POLICY

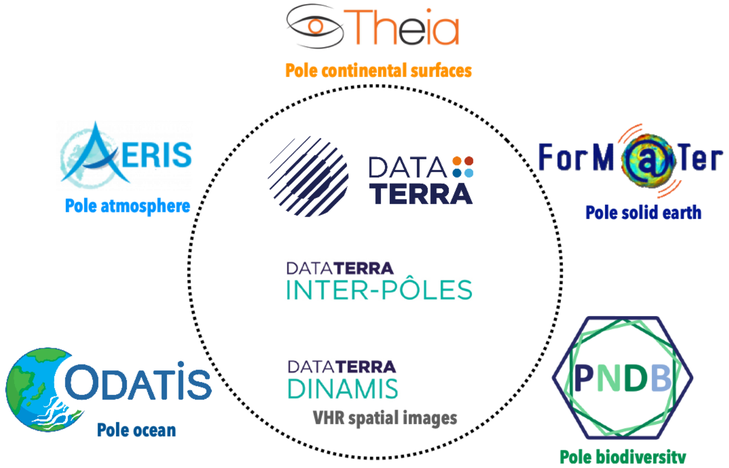
Open trusted public data policy

- FAIR observation, simulation and research data, open by default
- **Services Nationaux d'Observation** (SNOs)
- **Territorial network of Observatoires des Sciences de l'Univers** (OSUs)
- **National Research infrastructures** (RIs),
- **International organisations** (e.g. ESA, GEO/GEOSS), ESFRIs,
- European and international initiatives initiatives (e.g. GoFAIR, EOSC, CODATA/RDA)



Data poles: archiving and curation

- Linked to **long-term national observation programs and instruments**
- Linked to **ESFRI and international collaborative projects and organisations**
- **Data model harmonisation** (across disciplines) and **standardisation** (in disciplines)
- **FAIR services and domain data expertise** (Form@Terre, ODATIS, AERIS, Theia, PNDB, DINAMIS):
- **Mutualise/federate resources and critical mass of expertise in and across disciplines**



12 THE DIGITAL DATA TERRA E-INFRASTRUCTURE

French national digital infrastructures

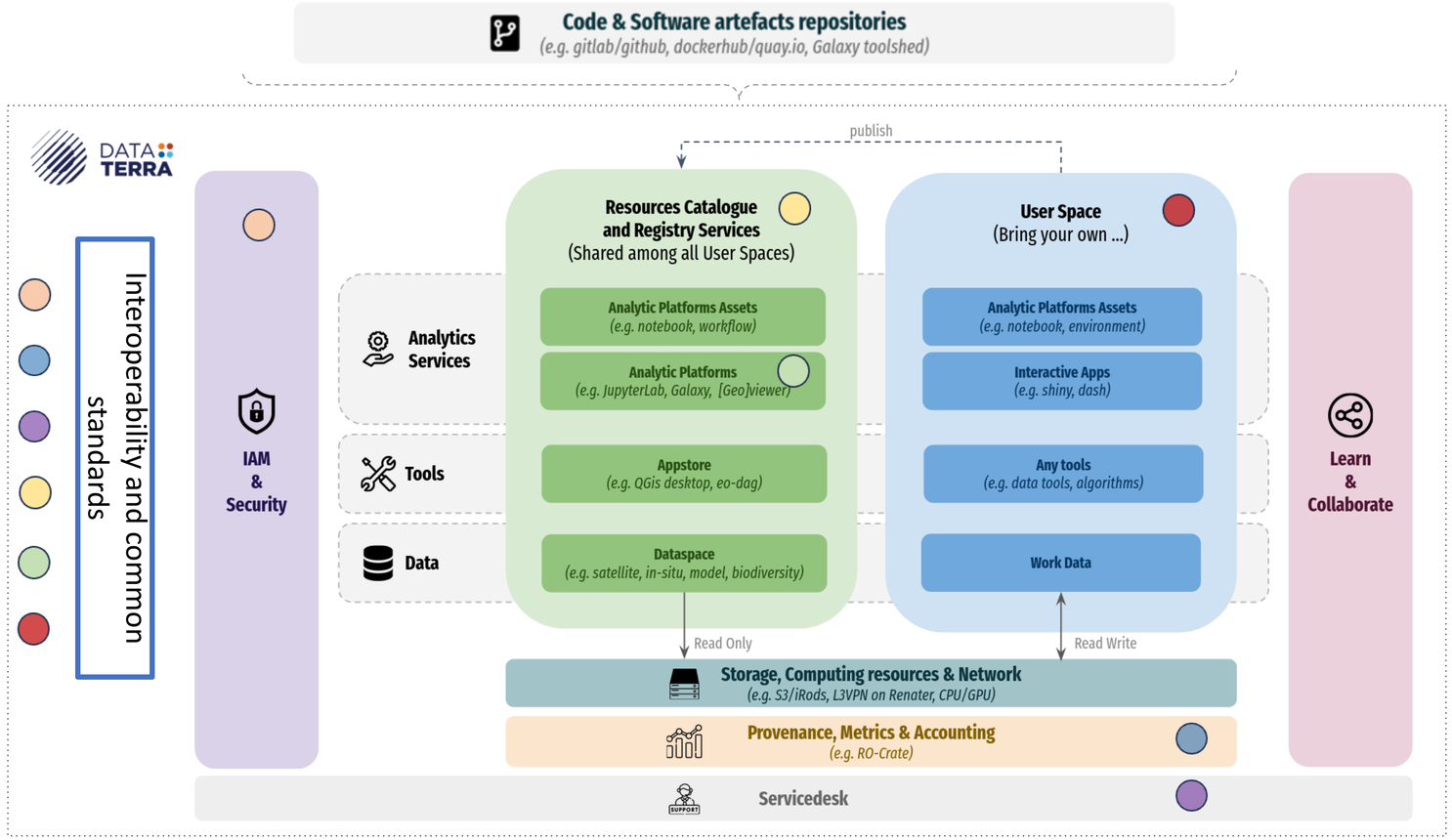
- Renater (Geant);
- MesoNet, France Grille (EGI), GENCI / EuroHPC (IDRIS, CINES, TGCC);
- Labelled National & regional data centres and mesocentres.

EOSC Federation

- D-T data and services accessible through the EOSC EU node;
- Services interoperability with other thematic cluster nodes and related national nodes.

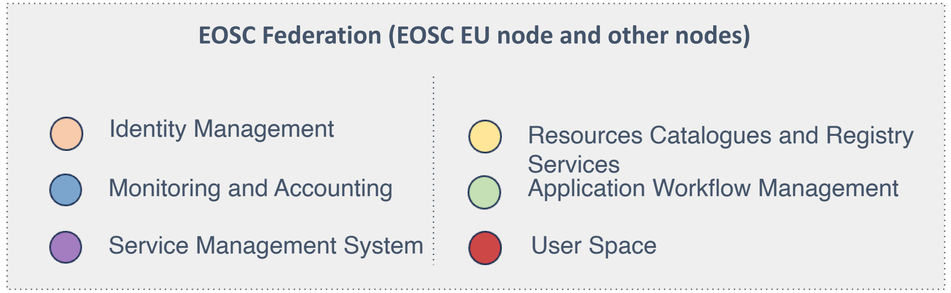
Core services

- Distributed data storage and management;
- Large data transfer (files, objects);
- User spaces (interactive notebooks, virtual machines, container images);
- HPC/Cloud computing services, Federated AAI.



Gaia data timeline allows to co-develop with EOSC EU node and third party (EOSC Federation)

Data Terra services designed to leverage and support EOSC EU Node and third party core services



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DATA TERRA: NATIONAL THEMATIC REFERENCE CENTRE FOR DATA GOUV

Data Terra: national thematic reference centres for Earth System, Environment and biodiversity data

- Reference data model harmonisation (across disciplines) and standards (in disciplines)
- Thematic thesaurus and ontology
- Interoperability standards
- Machine readable catalog/registries of trusted thematic repositories, data and software
- Actionable thematic Data Management Plan models
- French contribution to the international Earth system, environment, biodiversity ecosystem

Research Data Gouv (RDG)

The national platform for sharing and opening FAIR research data and a French contribution to the EOSC ecosystem

DATA TERRA

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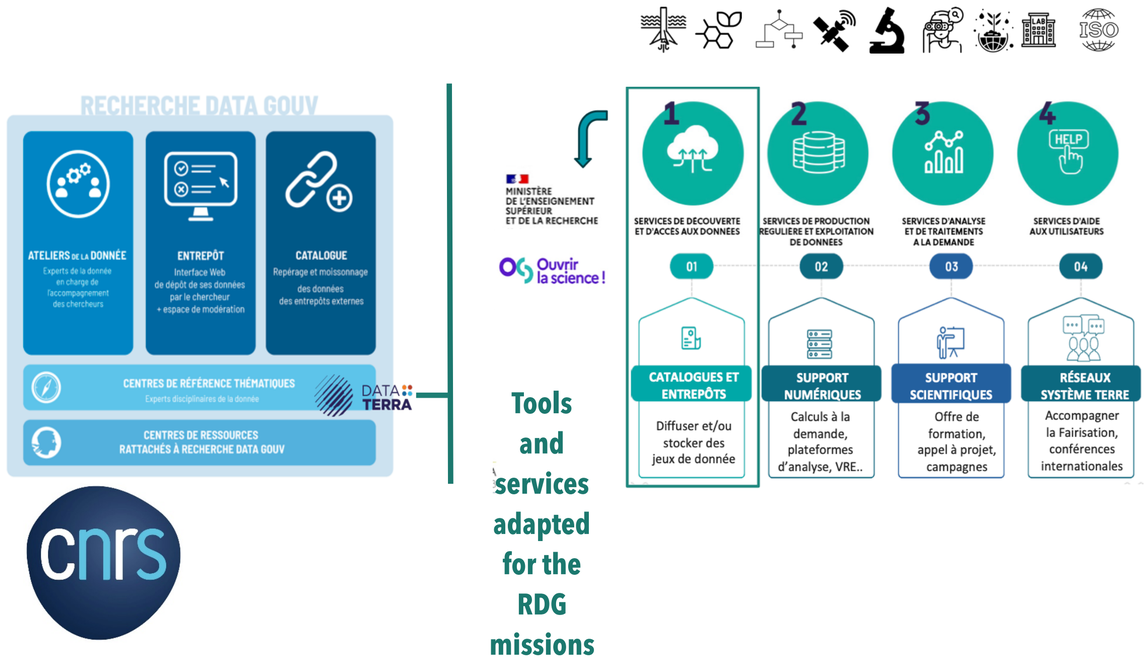
recherche.data.gouv.*fr*



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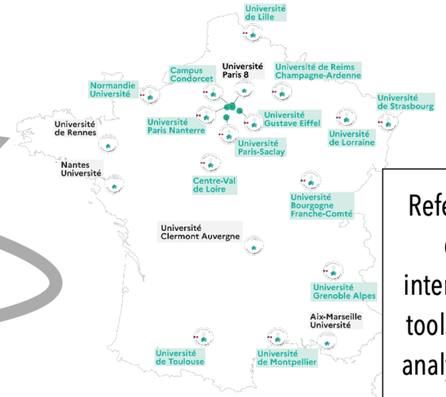
Thematic reference centres

DATA TERRA

PNDB

Data workshop map



Reference data models and standards, catalogs, certified national and international repositories, services and tools for description, access , curation, analysis and reuse of the Earth science, environment and biodiversity data

DATA TERRA: THE EUROPEAN LANDSCAPE

14

Contributes to an increasing number of EOSC projects through the CNRS-INSU

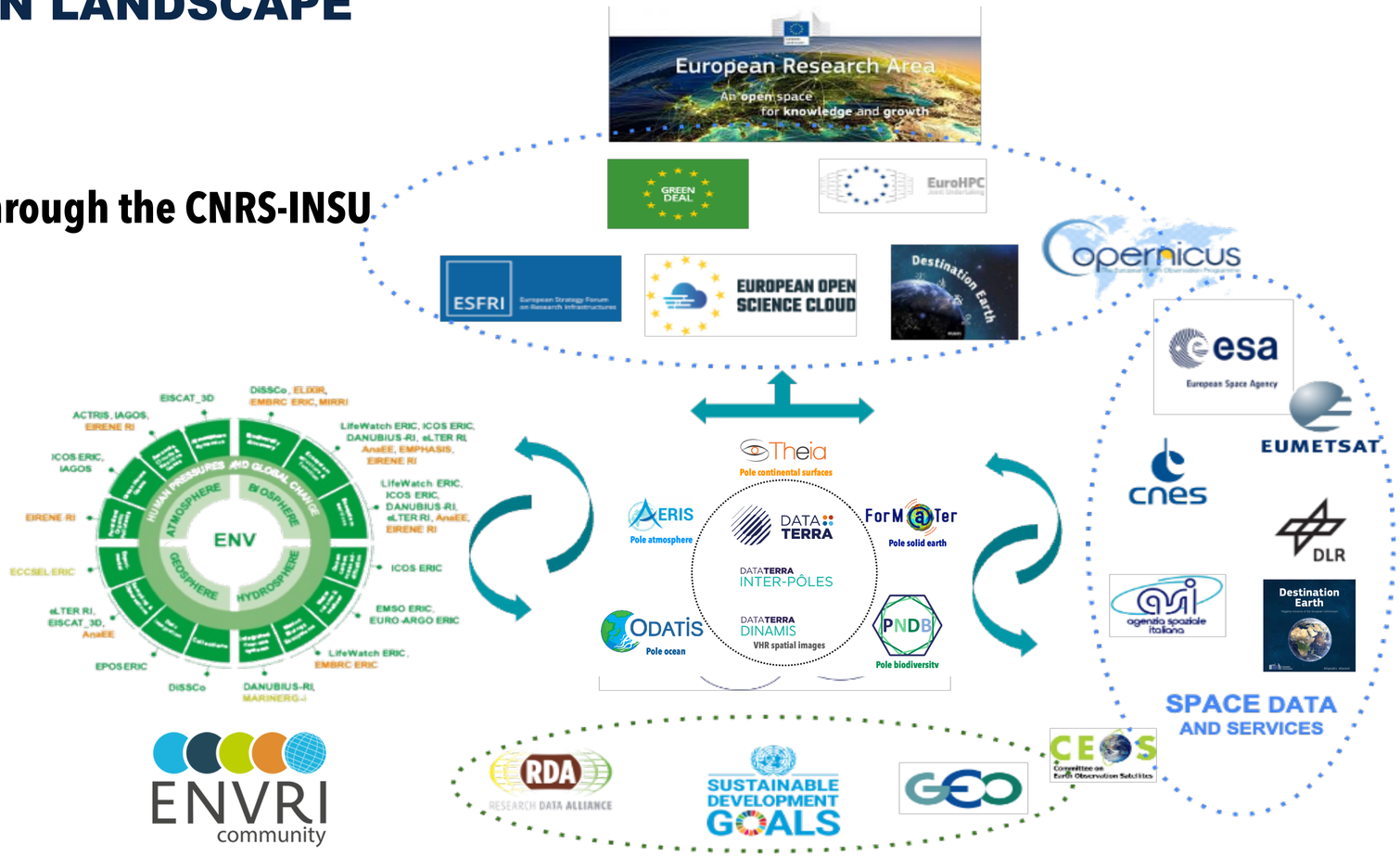
FAIR EASE (01/09/2022, 5M€, 26 partners, coord: Data Terra/CNRS A. Rizzo, IRD). Objectif: develop et leverage within EOSC the distributed and integrated observation and modelling for the Earth System, Environment and Biodiversity, with the user communities and the European Science Research Infrastructures. 143 PM/1,2M€

FAIR IMPACT (01/06/2022, 10M€, coord: DANS). Objectif: develop a FAIR EOSC « EOSC de données et de services FAIR », by supporting the practical implementation of the FAIR principles in the scientific communities and for research results at the national, European and international levels. 14PM

GEO INQUIRE (01/10/2022, 15M€, coord: GFZ). Objectif: Access to observations, data products and services for monitoring and simulating the geosphere dynamic processes, at unprecedented levels of detail and accuracy. 8PM

DT GEO (01/09/2022, 10M€, good: BSC). Objectif: Deploy a digital twin prototype for geophysical and human-made environmental extreme events: Coupled Digital Twin Components (DTC) for risk associated to earthquakes and induced seismicity, volcanic eruptions, and triggered tsunamis (earthquakes, landslides). 4PM

others: BioDT, InterTwin



is-enes

ACTRIS FRANCE

ICOS Integrated Carbon Observation System

IAGOS

Euro-Argo

emso ERIC

JERICO RESEARCH INFRASTRUCTURE

SeaDataCloud

eLTER RI

EPOS ERIC EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

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Data Terra: integrated French contribution to ESFRIs

- ACTRIS, ICOS, IAGOS, EU-FAR, Euro-ARGO, EMSO, SeaDataCloud, JERICO, eLTER, EPOS
- ENVRI-FAIR, ELIXIR

CNRS-INSU DATA AND SERVICES INFRASTRUCTURES

E-infrastructure
ex.: IR DATA TERRA

VRE-Virtual Research Environment ; VAP – Virtual Analysis Plateform

Service de calcul (à la demande & systématique)

Découverte, Visualisation, Accès

Service de calcul systématique
→ produits de données

Cycle de vie en entrepôt (DOI, Licence)

DataCenter

IR Observation
ex.: IR ACTRIS

Pôles Nationaux
de Données et de Services

Centre d'Expertise Scientifique

Centre de Données d'Observation et de Services

Centre d'Expertise Scientifique

Centre de Données d'Observation et de Services

Entrepôt de données

Entrepôt de données

Entrepôt de données

Base de données

Base de données

Système de fichiers

stockage objet

système de fichiers

opérationnel / coordination / physique

ROADMAP 2026 - TAKE HOME MESSAGES

- **European Research Infrastructures**: unique, innovative long-term collaborative observation and research tools for understanding the Earth, Climate, Environment and Biodiversity system, and Climate change solutions
- **More weight on the positioning of ESFRIs in the national federated Data Terra e-Infrastructure and on leveraging synergies from beginning** to:
  - foster links between and integration of RIs in the different compartment of the Earth, Climate, Environment and Biodiversity system in synergies with European national strategy (Data Terra, NFDI, ITINERIS, …)
  - increase links with the EOSC EU federation and the EOSC EU node services
  - steer the Data Terra E-Infrastructure needs and data and use of new digital tools such as A.I.
  - leverage Data Terra structure (UAR) for agile management of human resources and expertise at the national level
- **Get in touch with the National Delegates and SWG representatives at ESFRI** and the SWG, together with the CNRS TGIR committee (e.g. J. Rose for CNRS-INSU)