



## DATA TERRA, Earth System Science E-Research infrastructure

Earth data and services Integrated approach

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## SOMMAIRE

02

DATA TERRA Earth System Eresearch Infrastructure

The GAIA DATA project

03 INTERNATIONAL Collaboration

> MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR, DE LA RECHERCHE ET DE L'INNOVATION Librei Aparial Anterial Anterial





#### 01 DATA TERRA Earth System E-Research Infrastructure

3

#### **INTERNATIONAL CONTEXT : The Earth, a complex dynamic system**



Numerous geophysical and environmental processes, with different spatial and temporal scales, permanent interactions between the solid Earth, land surfaces, ocean, atmosphere compartments as with the **anthroposphere**.

#### **EVOLUTION OF THE NEEDS**

- More integrated approaches to complexity
- > Multi-source data, multi-sensor allowing multi-scale (spatial, spectral & temporal)
- Coupling of in-situ & space data
- Need of **long-term** data series and services  $\succ$
- Integrated **AI** and **big data** services
- Interdisciplinaries  $\succ$



**WEATHER CHANGE** 

BIODIVERSITY **IMPACTS** 

COS COS Tremer CON INRAO 🖄 🚨 🚾 🕬 Cerema CIrad ONERA OBSERVATOIRE DE LA COTE D'AZUR Université INERIS POLYTECHNIQUE de Lille UNIVERSITÉ CÔTE D'AZUR Université



#### A Research e-Infrastructure focused on the Earth system and environment



Data Terra's mission is to create an integrated platform encompassing Earth system data, services and products.

- $\rightarrow$  26 Research Organizations and Universities
- $\rightarrow$  30 Data and Services Centers (CDS)
- → 32 Consortium of Scientific Expertise
- $\rightarrow$  200 FTE / 450 scientists, engineers and technicians











#### **ATMOSPHERE DYNAMICS**



#### atmospheric physics and chemistry, climate change, air quality, etc.

The AERIS Atmospheric Data and Services hub brings together **data management activities** and **scientific expertise** in the atmosphere at the national level.

The data comes from platforms, observation networks, instruments on board satellites, balloons, planes, laboratory measurements, inventories, models, data from scientific campaigns.

#### **STUDY CASE : AIR QUALITY**





#### SOLID EARTH



Knowledge about the structure and composition of the Earth,

#### telluric risks and resources

The solid earth data and services center Form@ter brings together **data management activities** and **scientific expertise** in solid earth at the national level.

The data comes from satellite missions, in situ instruments and the results of experiments, modeling and simulations. Calculation services are also available.

#### **STUDY CASE**





#### **OCEANS DYNAMICS**



#### **Observing and understanding the dynamics of the oceans**

The Odatis ocean data and services center brings together **data management activities** and **scientific expertise** for the oceans at the national level.

The data comes from satellite missions, in situ instruments (fixed platforms, floats, gliders, radars, sea campaigns, laboratory measurements, ...)

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www.odatis-ocean.fr

DYNALIT



#### STUDY CASE



#### LAND SURFACES Observe the dynamics of land surfaces and natural resources



DE L'INNOVATIO

The Theia land surfaces data and services hub federates ecosystem and environmental resource monitoring activities at the national level.

The data comes from **satellite missions and in situ instruments**. They support the development of value added **products, models and software in ten themes**: agriculture, biodiversity, climate, water, forest, coast, snow & ice, natural risks, health, urban.

#### STUDY CASE

#### SOILS OCCUPATION **URBAN PLOTS GLACIER ALTITUDE SNOW COVER** BIOMASS HUMIDITY CHANGE PRODUCTION PLOTS COS COS Tremer VIII IGN INRAO 🕺 🚨 🗠 🕬 OBSERVATOIRE DE LA COTE D'AZUR www.theia-land.fr Cerema CIrad ONERA Université **INERIS** ECOLE POLYTECHNIQUE de Lille ENSEIGNEMEN UNIVERSITÉ CÔTE D'AZUR

Université

lermon





#### DINAMIS SERVICES Access to and use of very high spatial resolution satellite images

#### An institutional offer

Pleiades specific coverage metropolitan and French Guiana sandy coastlines, DOM TOM...

Vintage covers SPOT 6-7 Metropolitan France Ad-hoc acquisitions Pléiades and SPOT 6-7 Worldwide - Expressed by UIAs, regardless of their place of employment.

High resolution complementary images Relay to the CNES Spot World Heritage program (Spot 1-5), CNES PEPS platform (Sentinel 2), Geosud, CNES Kalideos program: RapidEye, CosmoSkyMed, TerraSar, -X, Aster...



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#### FOR 3 USERS SEGMENT

**French Authorized Institutional Users** For scientific research, higher education and territorial actors

**Foreign Scientific Authorized Institutional Users** For cooperation in the South, in the European Union and internationally

**Private users (France)** For R&D project leaders and public order providers

dinamis.data-terra.org









### D2 The GAIA DATA project : integrated data and services approach

#### **ISLANDS : a polymorphic and complex natural and human ecosystem**



#### The challenges to monitor remotely

- Diversity of situation
- lack of date, unifying thematic products (land-cover, ...)
- highly dynamic and constantly changing environment
- combining capacity of satellites
- different scale : from local to large-area monitoring
- A need to support both regional and global long-term monitoring
- long-term monitoring land and ocean cover to study changes in climate and impacts
- dynamic indicators





Models

#### Services to develop

Easy access to multi-source data

Full data cycle services development

#### FAIR criteria

Base on existing capacities, institutions, structures and resources

Interoperability of services

**integrated multi-disciplinary approaches** for the use of Earth-observation research data



physical / biological

variables



#### GAIA DATA INTEGRATED PLATFORM



#### 8 main networked data and services centers

#### Equipex+ or PIA4 infra

- FITS
- MesoNet
- Clusster

#### **Equipex+ or PEPR thematics**

- Obs4Clim
- TerraForma
- Marmor
- OneWater

#### H2020 Projects – Horizon Europe

- IS-ENES
- PHIDIAS
- EOSC-Pillar
- FAIR EASE
- FAIR IMPACT

#### Projets CPER en région

- Creation of a dedicated high-speed and secure network
- Deployment of a data grid (iRODS AC system) / S3 remote access to data and rapid automatic transfer of large data sets from one center to another
- Interoperability of processing between the 8 centers, with HPC centers in France and with commercial clouds (GAIA-X DIAS)





#### SERVICES





Research, Access and Data Management Services

**Research** (navigating through thousands of datasets)

**Catalog** (metadata, vocabularies, ontologies)

**Consultation and access** to data via integrated platforms

Advanced dataviz

Supporting **FAIR** scientific communities



Transversal services facilitate transdisciplinary research work

Data grid, cloud, knowledge management system, SSO, metrics, user support & training – community animation

Supporting campaigns

Analysis Ready Data Datacubes, ...



#### Earth Analytics Lab Data exploration

Virtual Analysis Platform -VAP : Notebook/PANGEO/ STAC ecosystem

Datacubes

Ability to connect directly to On-demand Processing centers (WPS)

NoCode/Low Code: Galaxy-E, FG/VIP, ~Matlab/Simulink



## Regular production services

**Optimization** of processing (orchestration tools) and data formats (Zarr, CoG, Dask, ...)

Supporting on a continuum of shared infrastructures



#### **SNO ReefTEMPS**

Réseau d'observation des eaux côtières du Pacifique insulaire



**ReefTEMPS** observation service of the French **Research Infrastructure ILICO**.

A network of **temperature**, **pressure**, **salinity** and other **observable sensors** in the coastal area about **twenty territories and island states of the Pacific**.

<u>Main goal</u>: long-term monitoring of climate change and its effects on the state of coral reefs and their resources.





Real-time temperature monitoring (1m and 4m) measured by the Bouraké Front buoy in New Caledonia <u>https://aqualink.org/sites/2892</u>





### Micro-endemism in New Caledonia



Characterization from freshwater zooplankton and proposal of a

functional ecology model

The biological, geological and climatic context of New Caledonia is particularly remarkable due to the **association of factors and conditions of exceptional character.** It is one of the **major biodiversity hotspots in the world** and has the **highest proportion of endemic species** described in all French territories (56% according to the INPN booklet, 2021).

<u>Main goal</u>: To enrich the knowledge and understanding of the New Caledonian ecosystems directly actionable for the protection of ecosystems







#### **Terre Solide: volcans du Vanuatu & subduction megathrusts**



2021-05-11



#### Subduction earthquakes Seismic stations of New Caledonia, Vanuatu, Futuna of the **GEOSCOPE** network monitor megathrust earthquakes

CRZF O PAF

0 CCD

MINISTÈRE DE L'ENSEIGNEMENT UPÉRIEUR LA RECHERCHE DE L'INNOVATION





## 03 INTERNATIONAL COLLABORATION

#### **ERUPTION TONGA**

**14 jan. 2022** the volcanic eruption caused waves that hit **Australia, New Zealand, Japan** and the **west coasts** of North and South America for several days.

All the information collected by scientists thus facilitates emergency response and helps to better understand and anticipate this type of natural disaster in the future.



The Tonga Islands are made up of approximately 170 islands



Eruption seen by Geostationnary Satellites Evolution of the Volcanic Island before and after the eruption

Measurement of the tsunami wave front by altimetry satellites and of the coastal surge by in situ tide gauges.

Mapping the Damage to guide rescue

#### **ERUPTION TONGA**





## National, European and International projects where DATA TERRA is involved



GROUP ON

ORSERVATIONS

#### **EARTH SCIENCE**

#### MARINE

EMODNet, SEADATANET,

#### BLUE CLOUD,

MARINE COPERNICUS SURFACES CONTINENTALES Copernicus Land, Climat C3S

ATMOSPHERE Copernicus CAMS

#### **TRANSVERSAL SERVICES**

**DATA GOVERNANCE** ENvri-FAIR, FAIR EASE, EOSC Pillar, FAIR Impact

HIGH PERFORMANCE CALCULATION PHIDIAS, EURO-HPC

**OPERATIONAL SERVICES** Copernicus Service C3S, CAMS, Land, Marine



FATES

ENVRI

EOSC



MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR, DE LA RECHERCHE ET DE L'INNOVATION Librei Apatoni Prateniet



## DATATERRA

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