National GEO activities
DATA TERRA E-Research Infrastructure
data (spatial, in-situ) and knowledge for earth system and
environment integrated observation

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DATA TERRA
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DATA TERRA

Earth System E-Research Infrastructure
The Earth, a complex dynamic system
- Numerous geophysical and environmental processes,
- With different spatial and temporal scales,
- permanent interactions between the solid Earth, continental surfaces, ocean,
- atmosphere compartments as with the anthrosphere.

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
- Integrated Artificial intelligence and big data services
- Interdisciplinarity

Understanding these processes requires access to and analysis of numerous, complex and voluminous data sources (satellites, in situ, campaigns, long-term observations as well as experimental results, models etc...)

Scientists and decision makers need to have an integrated easy access and on-demand treatments to all these data and associated products and services
AMBITION AND GOALS

Develop a global organization to access to data, products and treatments/services to observe, understand and predict in an integrated way functioning and evolution of the Earth system subject to global changes.

Data Terra allows, through interconnected portals, access to all of these standardized and interoperable FAIR data, thematic products and services for visualization and cross-referencing to address scientific issues and interdisciplinary societal challenges.

**Integrated platform**: Earth system sciences data, services and products.

- 26 Research Organizations and Universities
- 30 Observing Data and Services Centers (CDS)
- 32 Consortium of Scientific Expertise (CES)
- 450 scientists, engineers and technicians

**Achievements**:
- €42m/year
- 1000 products & services
- 15,000 regular users
- > 100 PB (2022/2023)

**DATA & SERVICES HUBS**
- Atmosphere
- Ocean, coastal
- Land Surfaces
- Solid Earth
- Biodiversity
- Climat models, data simulation

**CROSS-CUTTING SERVICES**
- HR Spatial Imagery
- FAIR Data and Services Networking Communities

**WORKING GROUP**
- SCIENCE, TECH, TRAINING, PUBLIC-PRIVATE partnership,
- EUROPE & INTERNATIONAL,
- COMMUNICATION/MEDIATION,
- COOPERATION South Countries

**BOLZANO 2-4 OCTOBER 2023**
European and international positioning
Data Terra: unified access to access Earth system observation data and services d’observation du système Terre

Catalog of data and services for each earth system compartments and for some transversal/commun services

- aegis-data.fr
- poleterresolide.fr
- odatis-ocean.fr
- theia-land.fr
- dinamis.data-terra.org

DestinE
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

AIR QUALITY MONITORING
CARBON & EMISSIONS ESTIMATION
EUROPEAN AIR QUALITY NETWORK INVOLVED
EFFECTS OF FOREST FIRES ON AIR QUALITY

www.aeris-data.fr/
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

www.poleterresolide.fr

APPLICATIONS
Large active fault zones and magmatic systems, landslides and lithospheric deformation on the scale of large massifs.
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, ...)

STUDY CASE

COASTLINE MONITORING
WATER OXYGENATION
WATER QUALITY
LASER / LIDAR BATHYMETRY

www.odatis-ocean.fr
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.

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...

dinamis.data-terra.org
The GAIA DATA platform: integrated data, distributed and transversal services
Gaia Data Project

GlobAl IntegrAted Data and services Research platform for Earth system, biodiversity and environment understanding

Implement an integrated platform for distributed data and services

Proposed by 3 research e-Infrastructures gathering 21 partners:

- Data Terra
  - organizes integrated access to observation data, products and services covering the various compartments of the Earth system (Ocean, Atmosphere, Land surface & Solid Earth) and their interactions

- CLIMERI-France
  - The French climate modeling e-infrastructure, its mission is to produce international numerical simulations for the WRCP and to make their results available to various users in France and abroad.

- PNDB
  - The french biodiversity data center, aims to federate existing data approaches within research infrastructures on “Living Earth”

EQUIPEX+ project funded by the (French) Program of Investments for the Future - France 2030 – ANR (2021-2028)
Rated A+, granted 16,2 M€, global budget : 65 M€, 2021-2029
A DISTRIBUTED DATA AND SERVICES INFRASTRUCTURE

8 principal sites
30 existing sites
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
  - EOSC-Pillar
  - FAIR EASE
  - FAIR IMPACT
  - ENVRI-HUB

Related projects

- DESTINATION EARTH
- Creation of a dedicated high-speed and secure network (10 to 100 Gbit/s) already operational between certain sites
- Deployment data grid (iRODS AC system) / S3 remote access to data and rapid automatic transfer of large data sets from different centers
- Interoperability of processing between the thematic centers, HPC and with commercial clouds services (GAIA-X - DIAS)
| SERVICES |
|-----------------|-----------------|-----------------|-----------------|
| **Research, Access and Data Management Services** | **Transversal services facilitate transdisciplinary research work** | **Earth Analytics Lab** | **Regular production services** |
| Research (navigating through thousands of datasets) | Data grid, cloud, knowledge management system, SSO, metrics, user support & training – community animation | Data exploration | Optimization of processing (orchestration tools) and data formats (Zarr, CoG, Dask, ...) |
| Catalog (metadata, vocabularies, ontologies) | Supporting campaigns | Virtual Analysis Platform - VAP: Notebook/PANGEO/STAC ecosystem | Supporting on a continuum of shared infrastructures |
| Consultation and access to data via integrated platforms | Analysis Ready Data | Datacubes | |
| Advanced dataviz | Datacubes, ... | Ability to connect directly to On-demand Processing centers (WPS) | |
| Supporting FAIR scientific communities | | NoCode/Low Code: Galaxy-E, FG/VIP, ~Matlab/Simulink | |
Discovery Portal

**Single point of access**

**Multiple entries**

- **vocabularies and ontologies** to select datasets

- **Thematic portals, hubs, areas or projects**

Visualization (WebMap)

Access / explore all available data

« User WebMap"
View a user-defined and configured set of datasets

Entry by domain (ex: Ocean): Pointer to "Ocean" theme page

=> Information on space missions and related data

WebMap presenting only data relating to the Ocean

Set of ocean-related services
APPLICATIONS
**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.

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<th><strong>DataTerra</strong> Services</th>
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**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**

*The Tonga Islands are made up of approximately 170 islands*
Images Pléiades-HR post-événement (à droite) et des images WorldView pré-événement (à gauche) sur les îles

Propagation de l’onde de Lamb et propagation du tsunami associé, 3 heures après l’explosion. A gauche : champ de pression en surface (en Pa) modélisé par une onde sinusoidale se propageant à la vitesse du son. A droite : élévation de la surface de l’eau (en m) générée par l’onde de Lamb et simulée

Perturbations du champ de température dues aux ondes de gravité se propageant dans la stratosphère mesurées par le sondeur IASI

Anomalies du niveau de la mer (hauteur du niveau de la mer par rapport à une moyenne à long terme) mesurées par Sentinel-3A et -B, Sentinel-6 et Jason-3, les 14 et 15 Janvier à 04:15 UTC6
HYDROWEB: WATER LEVELS OF RIVERS AND LAKES

Continuous, long-duration time-series of the levels of 64 lakes and 248 virtual stations on rivers (500 virtual stations at the end of 2018).

Satellite altimetry is used to measure the water level currently Jason-3, Sentinel-3A and in the future Sentinel-3B, Jason-CS and SWOT.

SOIL MOISTURE MAP

VERY HR RESOLUTION

Source data
Sentinel 1: main source for radar signal inversion with neural networks
Sentinel 2: for contribution of vegetation to the total radar signal
Theia Land Cover map: to extract agricultural parcels
Scale: sub-parcel scale
Production by Theia: 6 days update over some regions

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