AERIS atmosphere Data Centre Tools and data services for Satellite cal/val

Sébastien Payan, Patrice Henry – AERIS et Data Terra

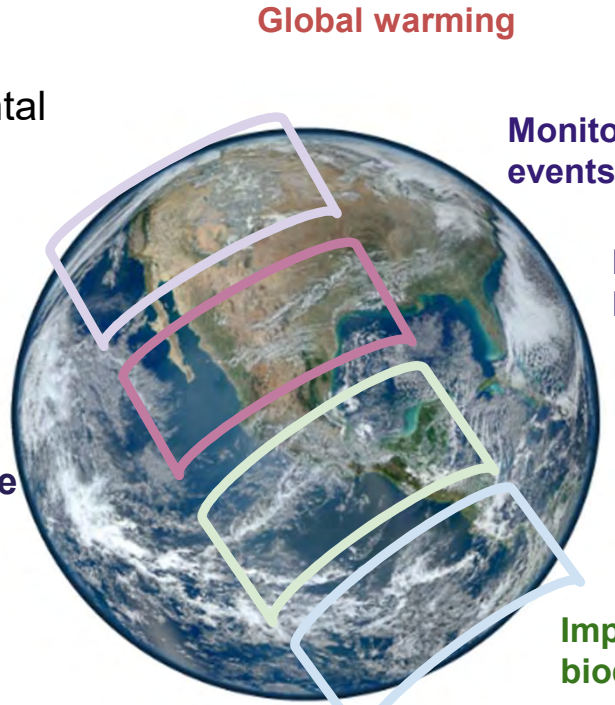
21st meeting of the CEOS Atmospheric Composition Virtual Constellation (AC-VC)
held on 9-13 June 2025 in Takamatsu, Japan

THE EARTH, A COMPLEX DYNAMIC SYSTEM

- Several geophysical and environmental processes,
- At different spatial and temporal scales,
- Permanent interactions between the solid Earth, continental surfaces, the ocean, atmospheric compartments, and the anthroposphere.

EVOLUTION OF NEEDS IN SCIENCE

- **More integrated approaches to complexity**
- **Multi-source, multi-sensor data enabling multi-scale (in situ, spatial, spectral, and temporal), long-term series.**
- **Managing diversity and volume: supercomputers, cloud services, Big Data, and AI.**
- **Interdisciplinarity and cross-disciplinary nature of scientific communities**



Access to data and services by themes

DATA TERRA

PORTAILS DE DONNÉES ET DE SERVICES

- AERIS — ATMOSPHERE
- ForM@Ter — SOLID EARTH
- ODATIS — OCÉAN
- Theia — LAND SURFACES
- PNDB — BIODIVERSITY
- DATATERRA DINAMIS — SATELLITE IMAGES
- EaSy Data (Earth System Data Repository) — **Long-tail national data warehouse operated by BRGM**

CATALOGs

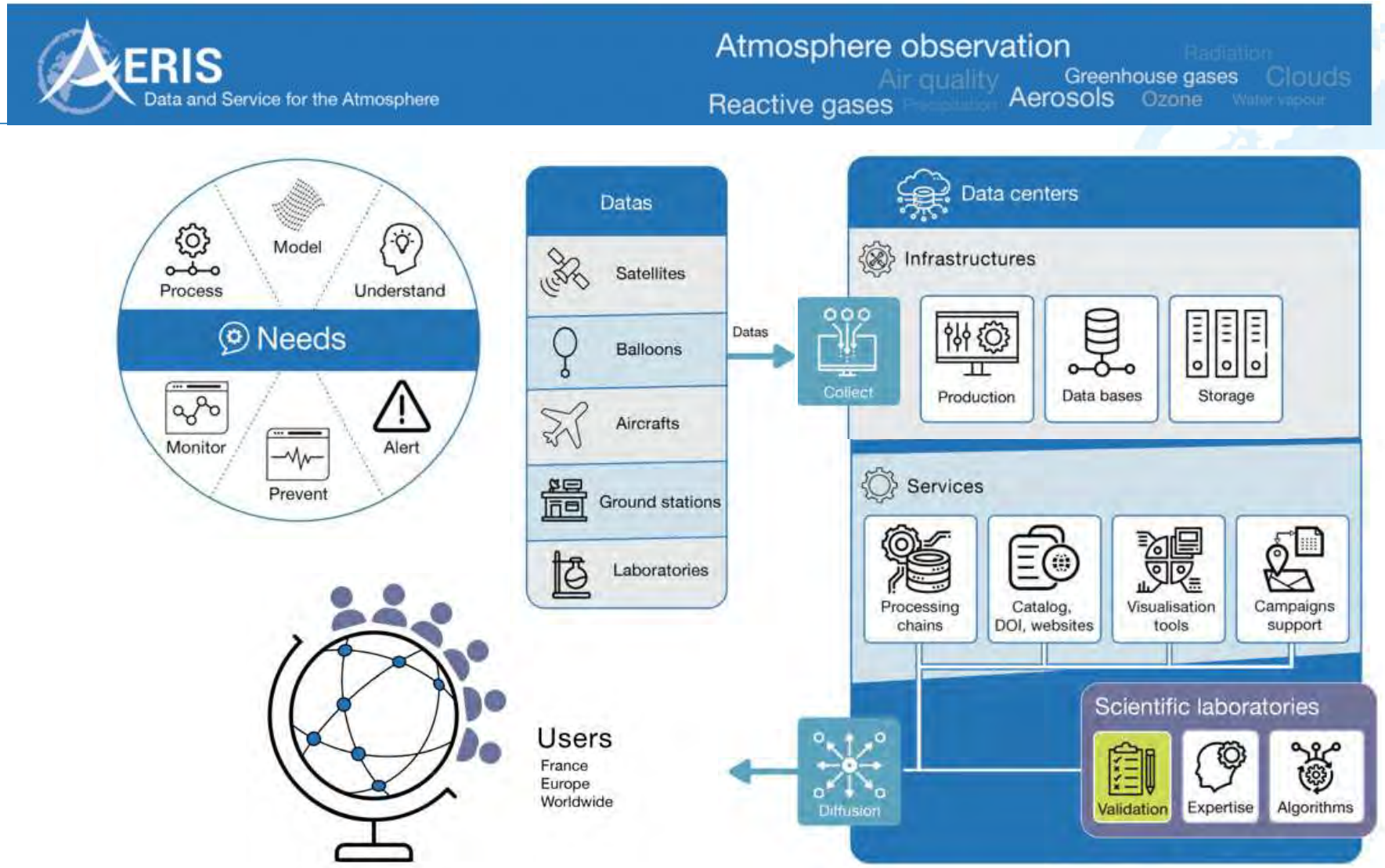
Multi-source scientific data: spatial, in-situ, ground, airborne (ballo

RELATED S

- Servic
- Comp
- Camp
- Softwa
- Calls for projects
- Newsletters and thematic workshops

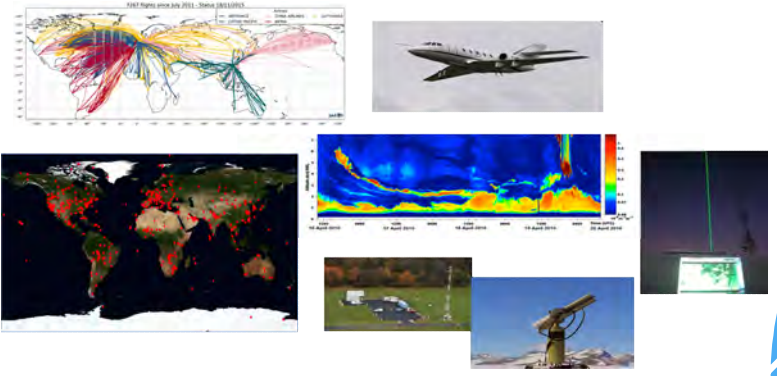
AERIS's mission is to bring together observation and campaign data produced by the French atmospheric science community and to deliver enhanced data and products to users to enable optimal exploitation of observation systems for studies at local, regional, continental and global scales.

AERIS: a unique hub for the Atmosphere



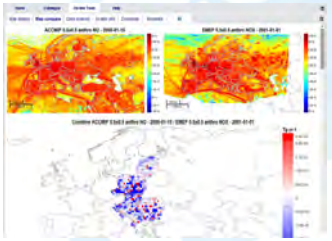
AERIS: integrated data and services centres

Ground and airborne data (planes, balloons)



Tools/Services

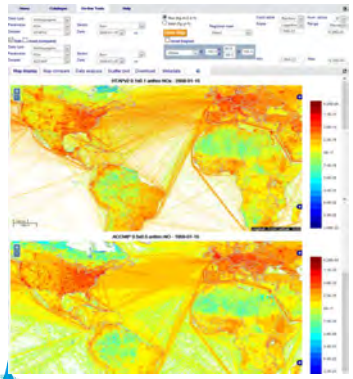
- Satellite-ground co-location
- Visualization
- Campaign support
- DMP
- FAIR



AERIS

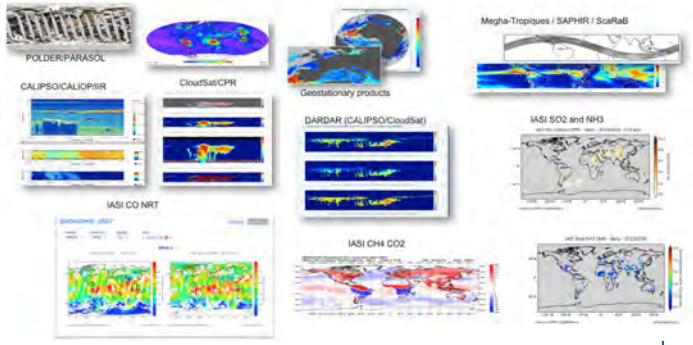
A single entry for the atmosphere data

Laboratory / Databases



- ECCAD
- IUPAC
- GEISA

Satellite data



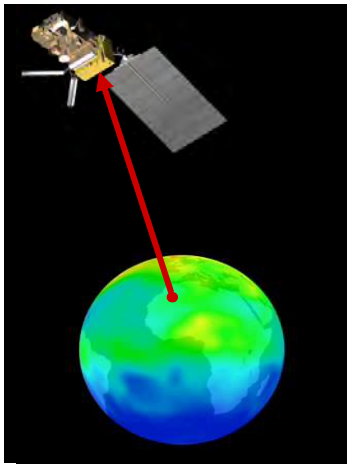
AERIS DONNÉES ET SERVICES POUR L'ATMOSPHÈRE

https://www.aeris-data.fr/

Satellite data : IASI/Metop-A/B/C

https:// iasi.aeris-data.fr

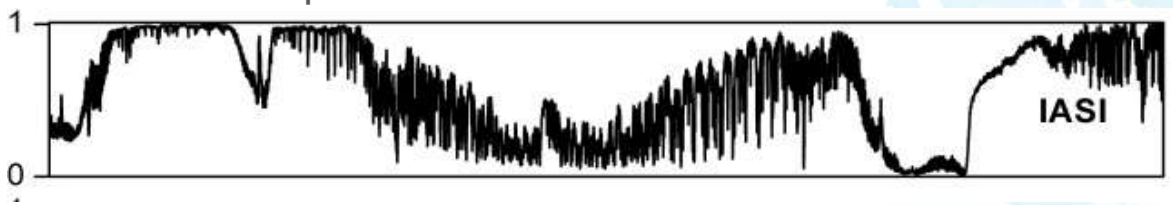
Acquisition and Management of data from Eumetsat

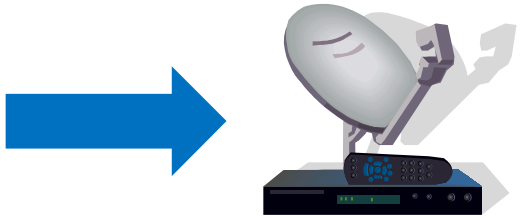


Observation

Scan – orbite

Spectra – level 1C data





Reception/Eumecast

ESPRI AERIS

Data Management

Data recovery in NRT (+3H) and flow management (automatic)

- Level 1C data: radiances (Metop-A since 2007 and Metop-B since 2013, C since Sept. 2019)

  → **50 To/an** **(MetopA data shutdown on October 15, 2021)**

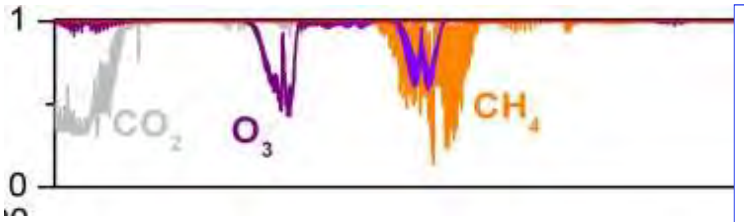
- Level 2 data: cloud parameters, T, Humidity, trace gases, CO_X, SO_2, Emissivity, O_3, HNO_3

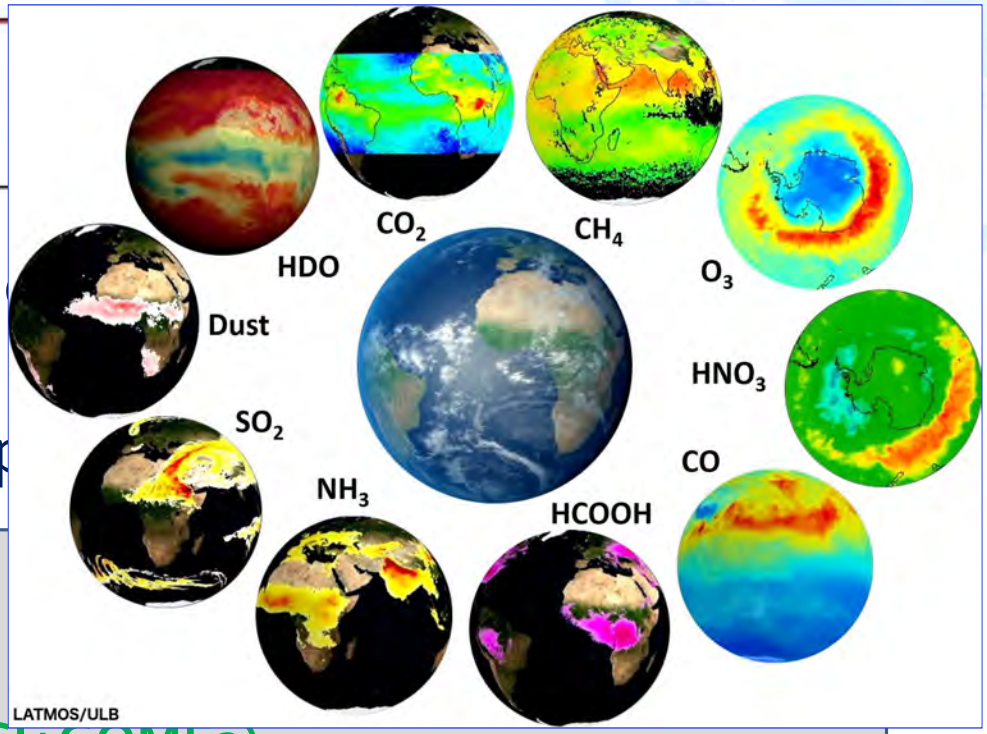
  → **1 To / an**

Satellite data : IASI/Metop-A/B/C

https:// iasi.aeris-data.fr

Production, distribution, **added value**





L2/L3 Production: 47 products currently ma
DOIs AERIS

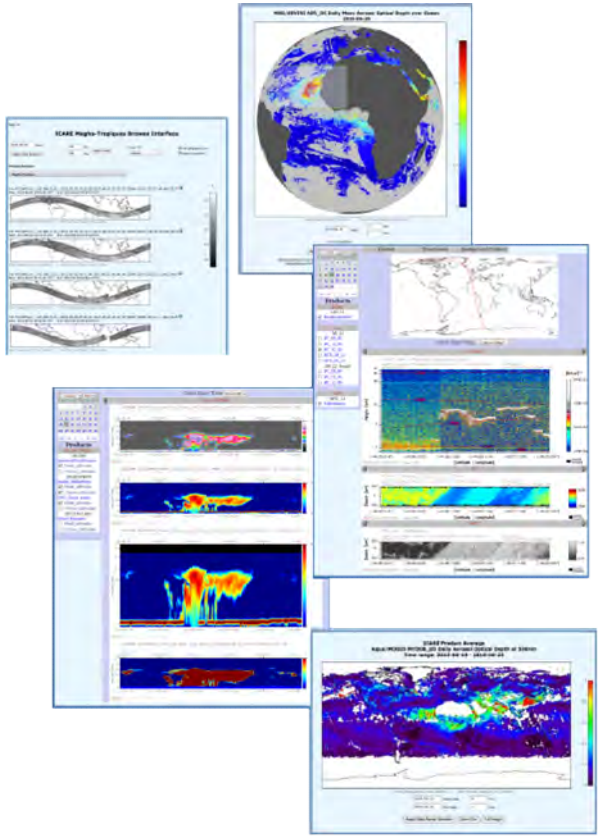
→ Laboratory products and AERIS p

LATMOS/ULB : CO, SO2, NH3 (2), HDO
LMD : CO2, CH4
AERIS : Cloud, DUST, HCOOH, O3 (IASI et IASI+GOME2)

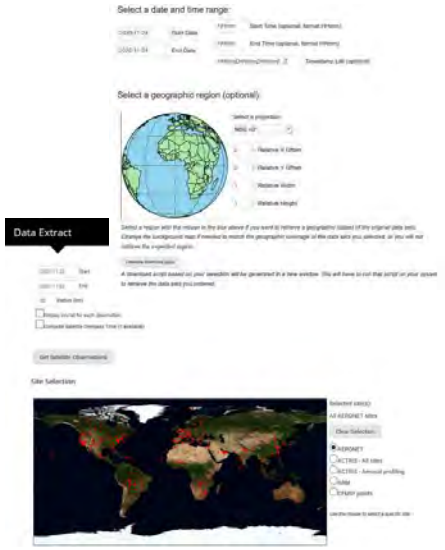
+ set of quicklook associated with the different products

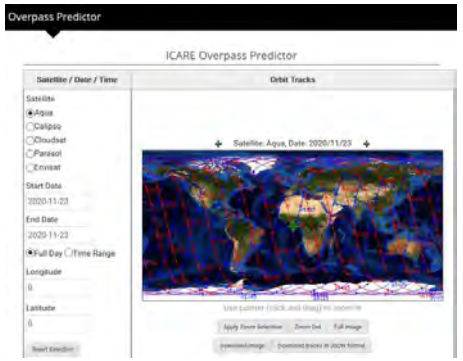
Integration of web services around the data

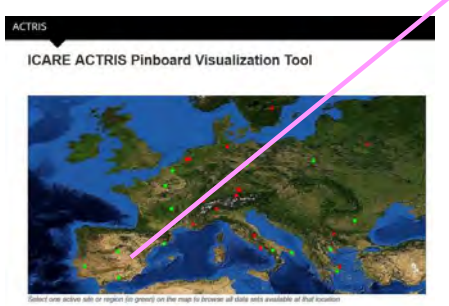
Visualisation

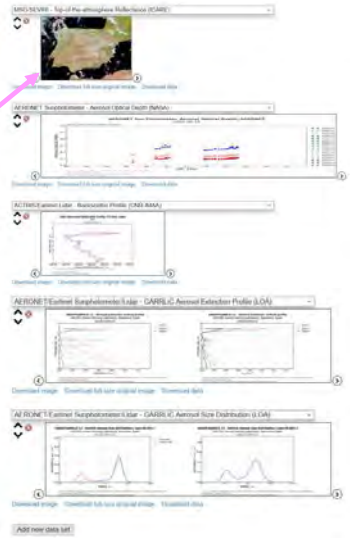


Extraction of data, prediction of orbits, coincidence of ground/satellite sites, etc.

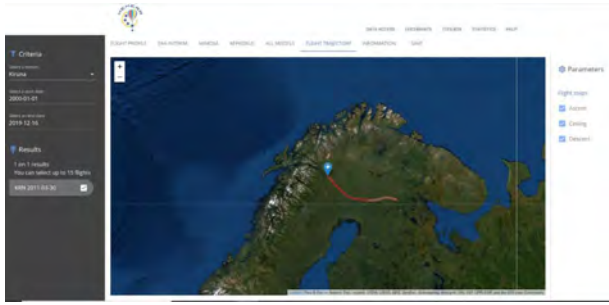


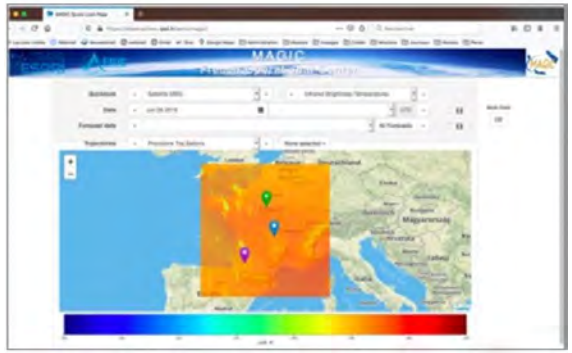






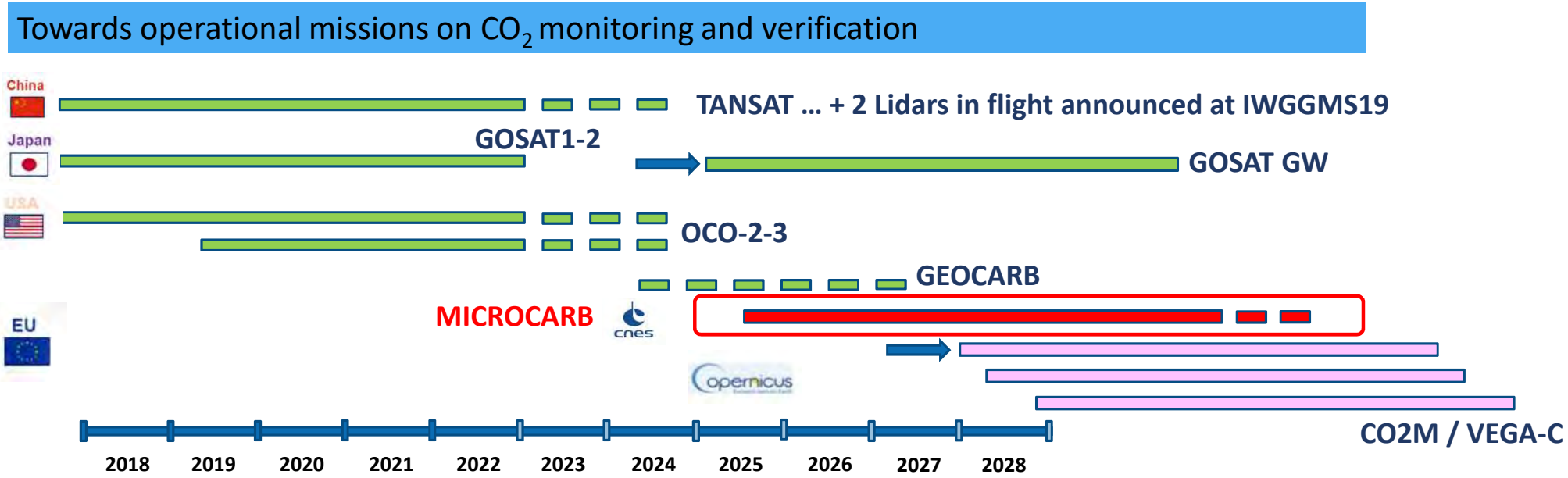
Trajectory, forecast, ...





Microcarb

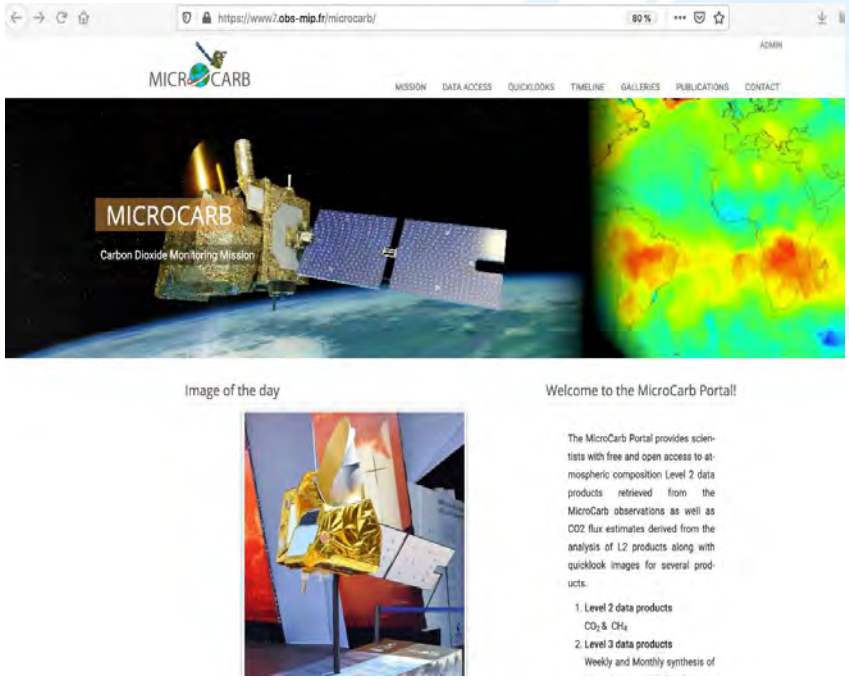
A mission that is still as timely as ever and its partner missions that are also being postponed: GOSAT, CO2M, …



MicroCarb very well positioned as precursor to CO2M and services that will be developed / proposed by ECMWF

MicroCarb

- Participation in the development of the Microcarb ground segment:
  - AERIS is contractually involved in the development of the ground segment, in the same way as CNES and Eumetsat
  - CNES develops data processing software (levels 1 and 2)
  - Eumetsat develops the operational processing chain which will integrate CNES software
  - AERIS will receive the data from Eumetsat and will be responsible for distributing it
- Provision of services and tools for data analysis :
  AERIS directly offers users to share workspaces, tools, databases, services to facilitate the analysis of Microcarb data and exchange results.



Microcarb Carbon Dioxide Monitoring Mission website

MICROCARB

MISSION DATA ACCESS DOCUMENTATION RESOURCES USER SUPPORT

MICROCARB

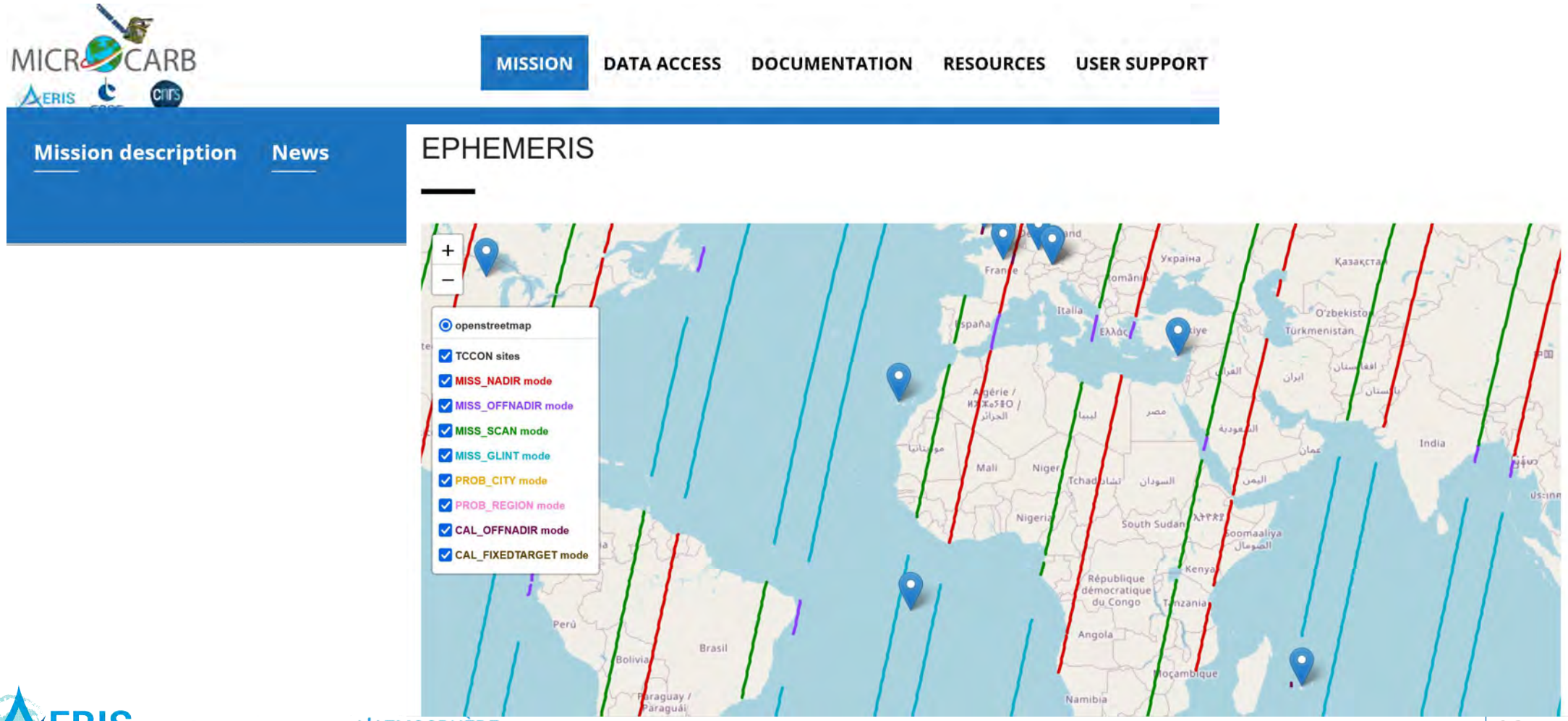
Carbon Dioxide Monitoring Mission

Image of the day

Welcome to the Microcarb Portal!

The MicroCarb Portal provides scientists with free and open access to atmospheric composition Level 2 data products retrieved from the MicroCarb observations as well as CO2 flux estimates derived from the analysis of L2 products along with quicklook images for several products.

Microcarb Carbon Dioxide Monitoring Mission website



Microcarb Carbon Dioxide Monitoring Mission website

DATA USE POLICY

For any use in a presentation or a publication, our data policy is as follows:

For minor use

CO/O_3/SO_2/NH_3/HCOOH/δD

IASI is a joint mission of EUMETSAT and the Centre National d'Etudes Spatiales (CNES, France). The authors acknowledge the AERIS data infrastructure for providing access to the IASI data in this study and ULB-LATMOS for the development of the retrieval algorithms

CH_4/DUST-AOD

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IASI+GOME2 O_3

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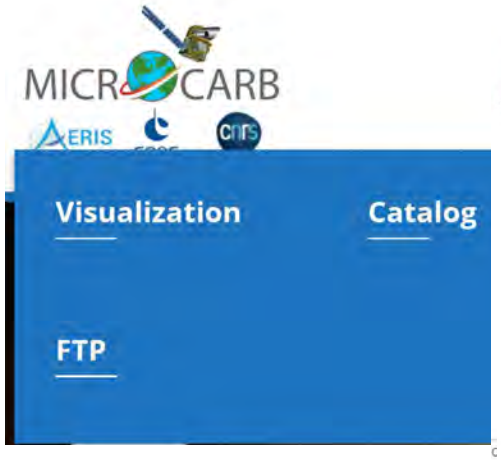
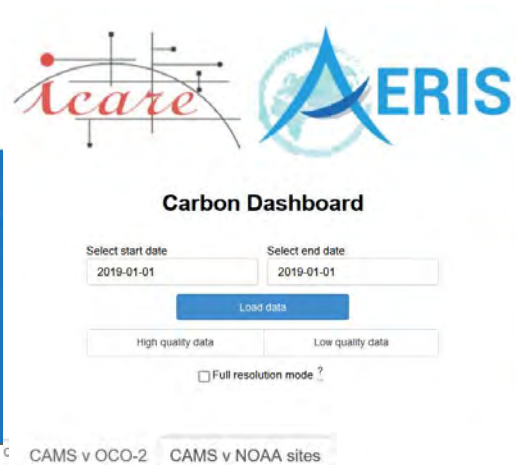
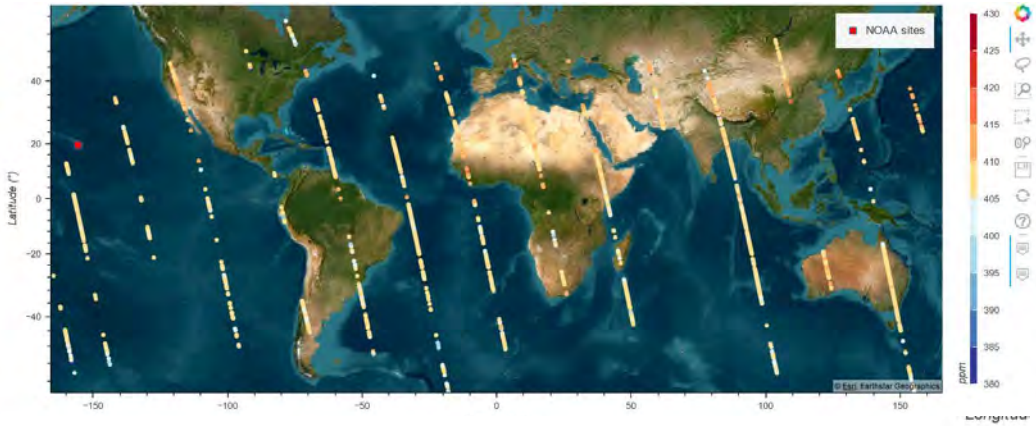
For substantial use

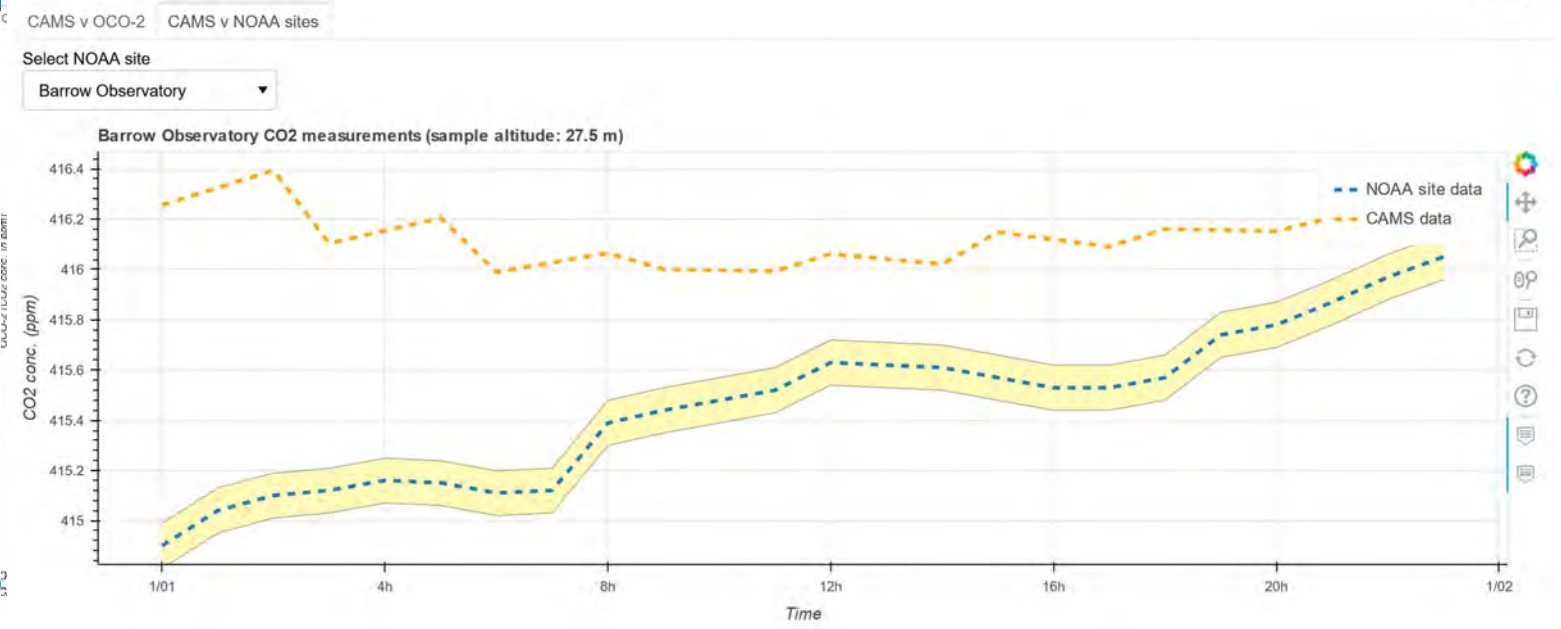
SPECIES	PRINCIPAL INVESTIGATOR
CO/O_3	Cathy Clerbaux cathy.clerbaux@latmos.ipsl.fr Pierre-François Coheur pfcoheur@ulb.ac.be
NH_3	Lieven Clarisse lclariss@ulb.ac.be Pierre-François Coheur pfcoheur@ulb.ac.be
SO_2	Lieven Clarisse lclariss@ulb.ac.be
CH_4	Cyril Crevoisier cyril.crevoisier@lmd.polytechnique.fr
DUST-AOD	Virginie Capelle virginie.capelle@lmd.polytechnique.fr
IASI+GOME2 O_3	Juan Cuesta juan.cuesta@lisa.u-pec.fr

Carbon dashboard (demo mode)









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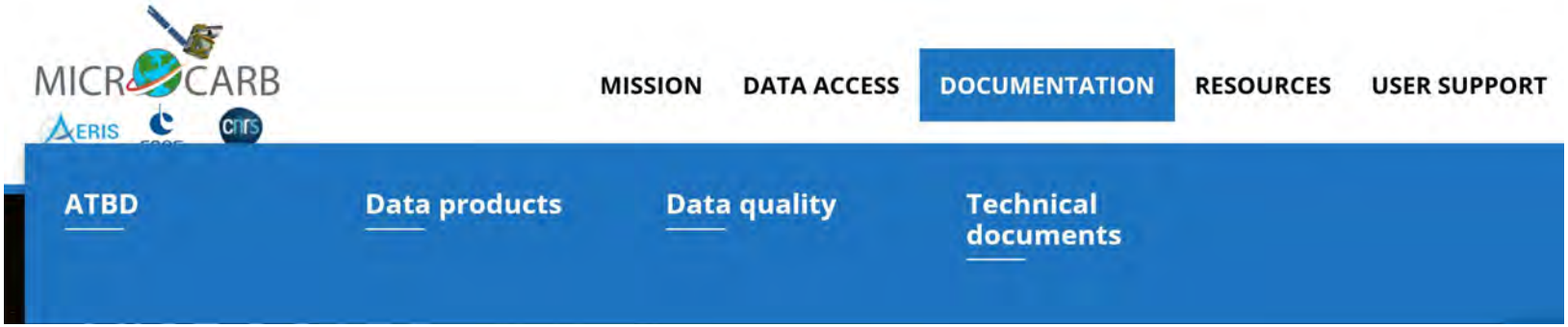

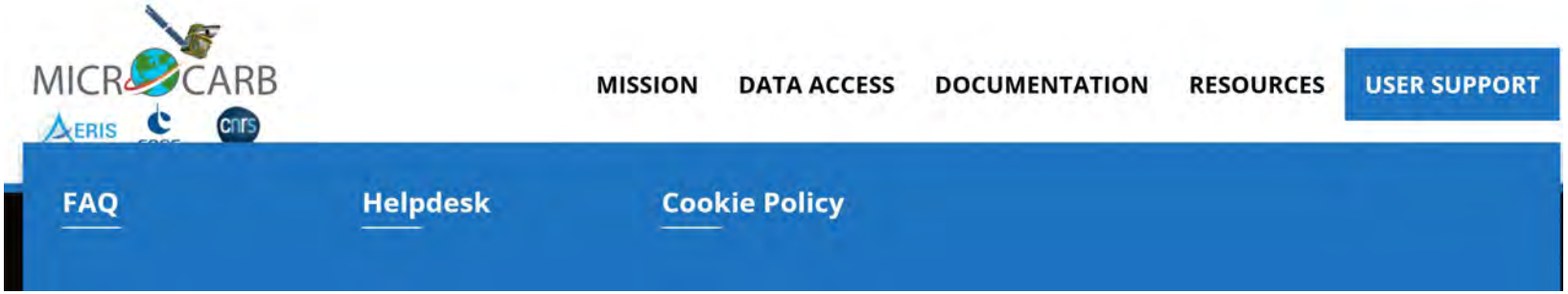

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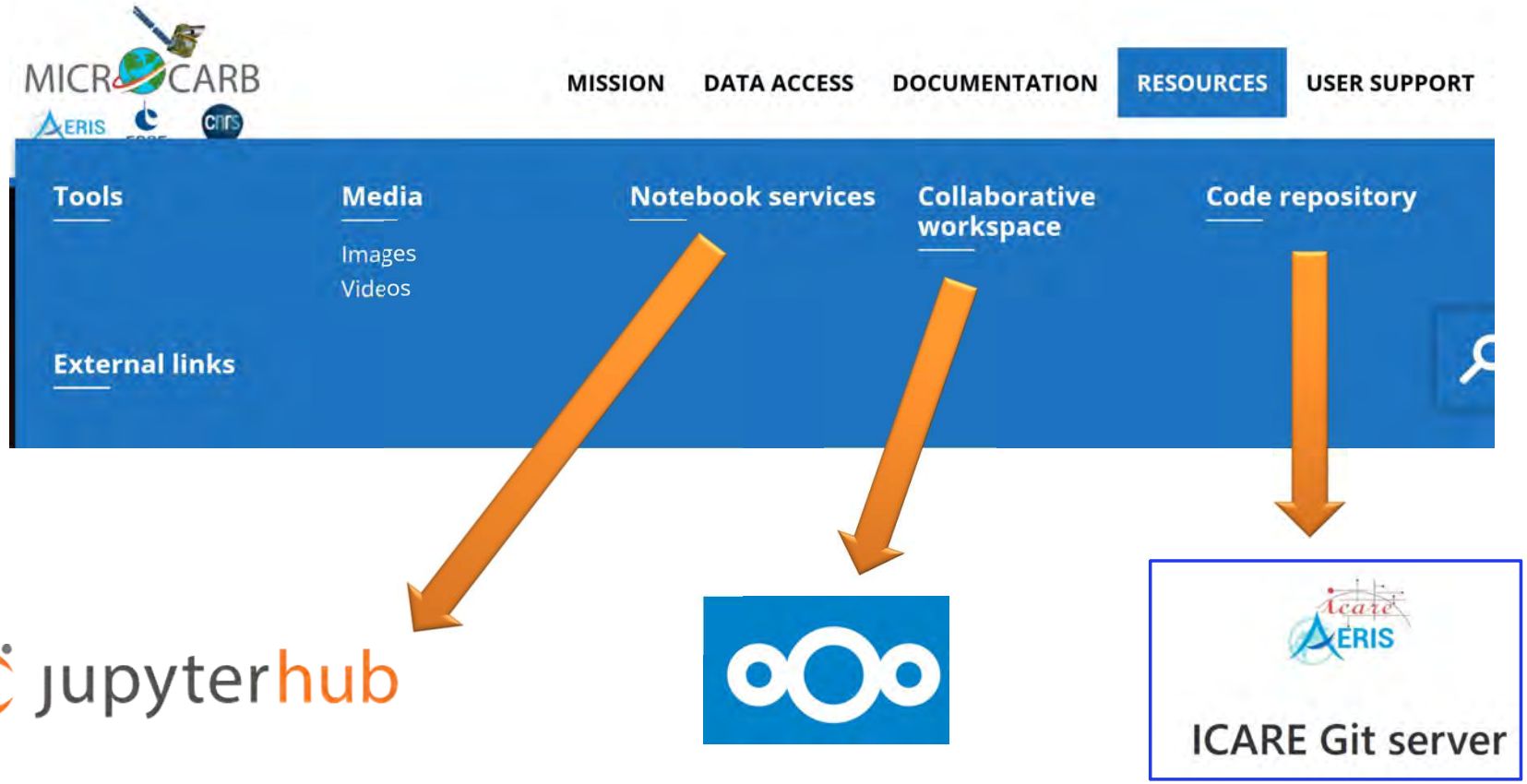


Monitoring of Atmospheric composition and Greenhouse gases through multi-Instrument Campaigns

The MAGIC initiative: Established in 2017 (Crevoisier and Bès, 2018) https://magic.aeris-data.fr

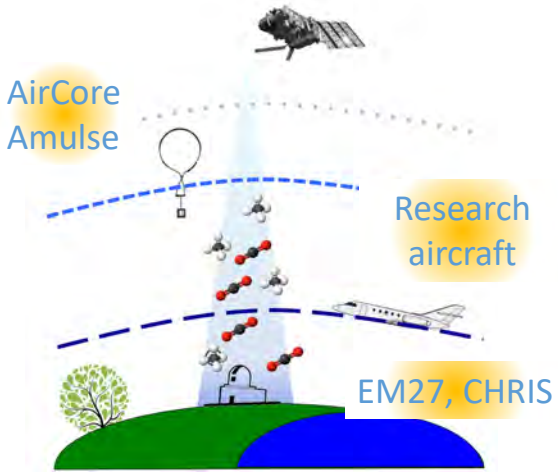
Two main objectives:

- To better understand atmospheric distribution and emissions of CH_4, CO_2 and related variables
- To validate current space missions (e.g. OCO-2, GOSAT-2, S5P, IASI) and prepare future ones (e.g. Merlin, MicroCarb, IASI-NG)

How?

- By organizing annual campaigns and network measurements and building numerical tools.
- By combining ground-based, airborne (aircraft, balloon) and satellite observations.
- By testing satellite airborne demonstrators.

Annual multi-instrument campaigns



Network for vertical profiling

Consortium for total column measurements

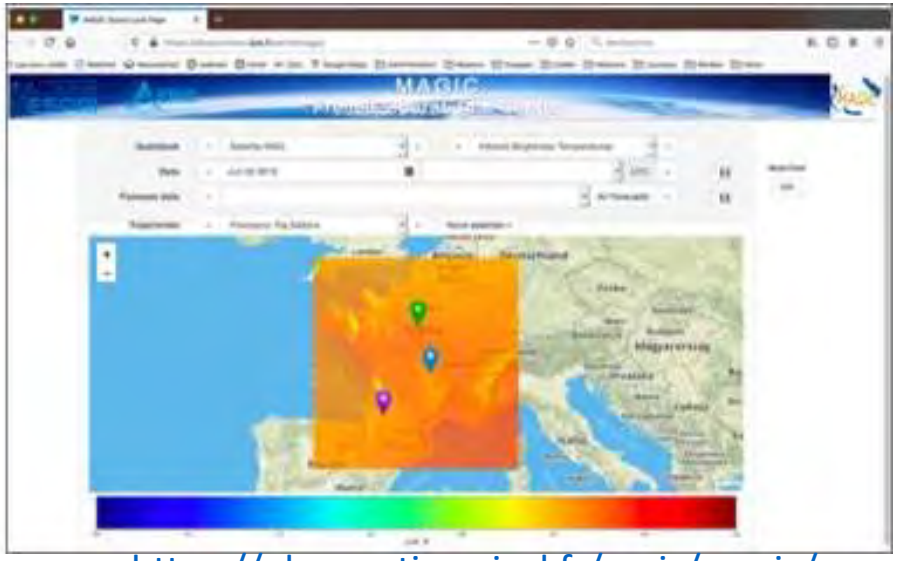
Funding: CNES, CNRS, + EUMETSAT, ESA + Univ. of Sorbonne, Reims-CA, UVSQ, CEA, E. Polytechnique

A few tools… building on previous MAGIC campaigns with the help of AERIS

Forecast of satellite trajectories (with IXION)
Used for selecting days/times of balloon launches
(campaigns+ launches from AIrCore-Fr network)

https://data.ipsl.fr/magic/dist/

Campaign planning



https://observations.ipsl.fr/aeris/magic/

- **Data Distribution:**
- via https://magic.aeris-data.fr → Access data ('catalogue' for previous MAGIC under construction).
- via https://aircore.aeris-data.fr

- **Other tools have been developed (comparison between several types of instruments and sat, co-location)**
  → project to transfer some of them to AERIS for operational purpose?

Diapositive 18

SP1 Sébastien Payan; 13/09/2022

AERIS and CNES space missions

- ✓ Establishment of AERIS as a Mission Center for the scientific processing and distribution of data and products from CNES space missions concerning the atmosphere.
  - ✓ Continued archiving and distribution of the PARASOL, CALIPSO, MEGHA-TROPIQUES, and IASI missions.
  - ✓ Distribution of MicroCarb Level 1 and 2 products + development of services for scientific data users.
  - ✓ Hosting of C3IEL processing chains, operational production, and product distribution.
  - ✓ Hosting and operation of C2OMODO Level 2 processing chains. Development of a Level 4 chain combining different AOS mission products
  - ✓ Development and operation of Level 2 IASI-NG processing chains
- ✓ Data valorization
  - ✓ Support for Cal/Val activities of European space missions: AEOLUS, EarthCare
  - ✓ Hosting of processing chains developed by French scientific laboratories and operational processing of these chains
  - ✓ Establishment of "thematic platforms" for the joint use of data: VOLCPLUME, Carbon Portal, etc.

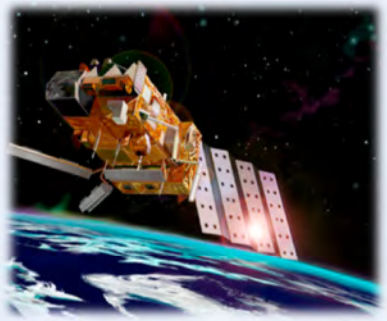
AERIS : an operational environment

Chain Development

- Development of processing chains based on specifications
- Operationalization of existing processing chains
- Operational processing
- Data recovery from agencies, observation sites, etc.
- Online and tape archiving
- Automated implementation of processing chains (production)
- Data dissemination (mass or customized dissemination)
- User support

Large volumes of data of a wide variety of types → support to lab.

- Currently: Incoming flow ≈ 700 TB/year (mainly Level 1 products)
- Stored data ≈ 9 PB
- Over a thousand products in the catalog



Currently :

- IASI
- EarthCare

This year

- MicroCarb
- MTG-IRD
- IASI-NG

contact@aeris-data.fr

AERIS DONNÉES ET SERVICES POUR L'ATMOSPHÈRE

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