

CNES projects for GHG MCROCARB & IASI NG status

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With contributions from **CNES project teams**
& french scientists
from **LSCE, LATMOS, LMD**

CEOS AC-VC, Leiden, June 4th, 2026

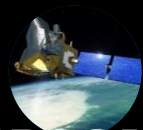
OUR FUTURE MISSIONS IN THE NEXT DECADE



SPS 2024 priorities

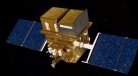
MICROCARB

Carbon from space



TRISHNA

Surface temperature & Soil moisture



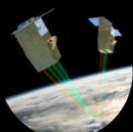
IASI-NG

Atmosphere composition



C3IEL

Convective clouds
& lightning



REVALTO

Daily water levels for surfaces



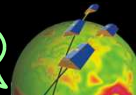
GENESIS

Geodetic references



MAGIC/NGGM

Earth's gravity field



MERLIN

Monitoring methane emissions



C²OMODO

Convection, aerosols & climate



CARIOQA

Quantum gravimetry



2035

2030

S3-NG-Topo

Wide-swath altimetry
for ocean & hydrology



2025



REPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité



The MicroCarb CO2 mission

Instrument

- Compact instrument (80 kg, 60W) on micro-satellite
- Passive grating spectrometer in 4 NIR / SWIR bands
 - CO2 1.61 μm & 2.05 μm , O2 0.76 μm & 1.27 μm
 - 3 ACT footprints 4.5x9 km²
- Embedded imager (red band resolution 140m)

Requirement for CO2 column integrated concentration

Precision 1ppm (T) & Bias < 0.2 ppm
+ SIF

XCO2 retrieval : 4ARTIC

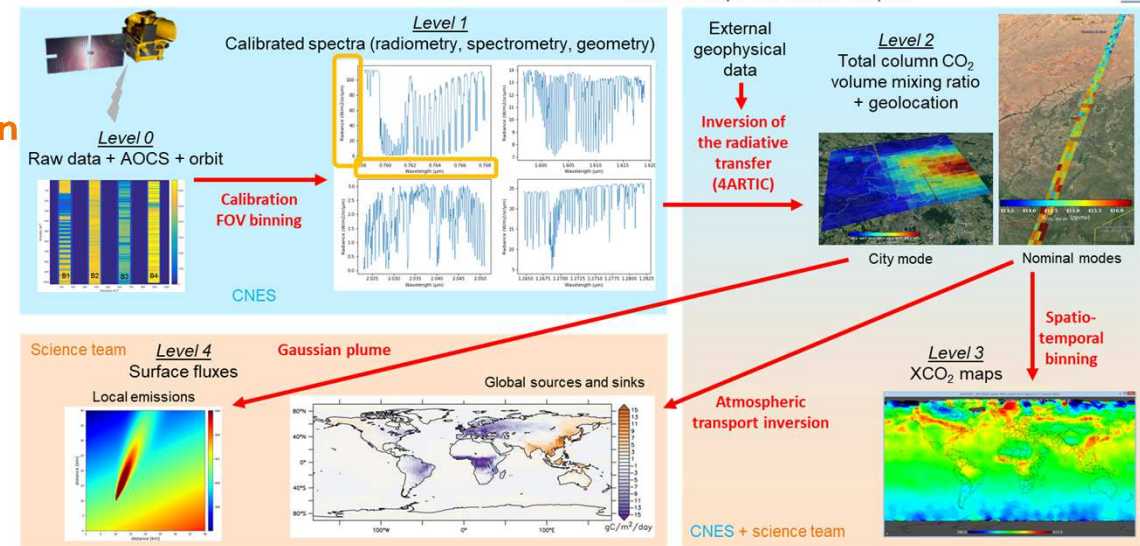
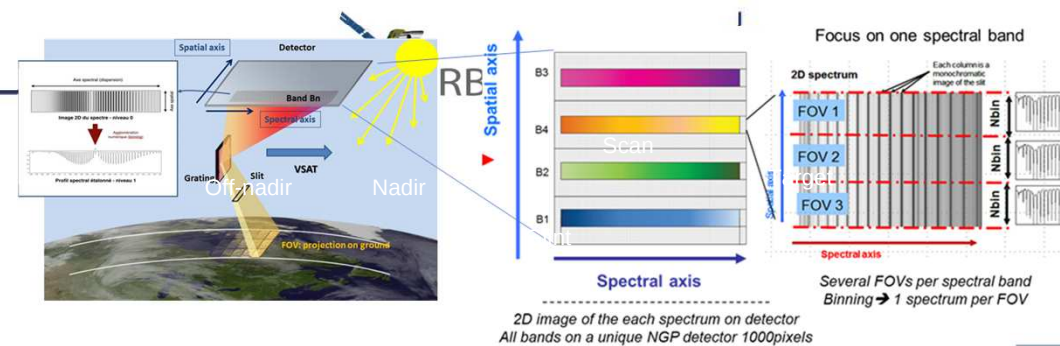
- Full physics, optimal estimation

Orbit

- Polar sun-synchronous, alt 649 km, LTAN 22h40
- Cycle 25 days, sub-cycle 7 days, $\pm 200\text{km}$ ACT mirror
- Any target can be observed once a week

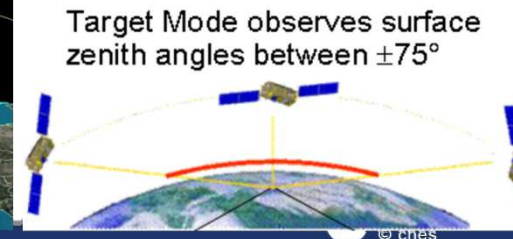
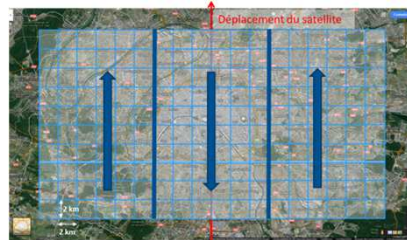
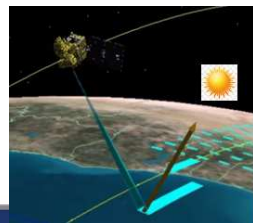
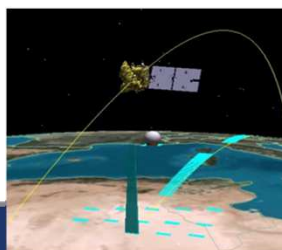
Science Observations modes

- Nadir (Land), Scan, Glint (Ocean)
(2x2km²)



+ city

+ Fixed-Target, Off-nadir target for validation



Target Mode observes surface zenith angles between $\pm 75^\circ$



Vega-C fairing closure



**Successfully
launched 26/07/2025
02:03 UTC
(KOUROU) with
VEGA-C (VV27)**

Very good injection in orbit

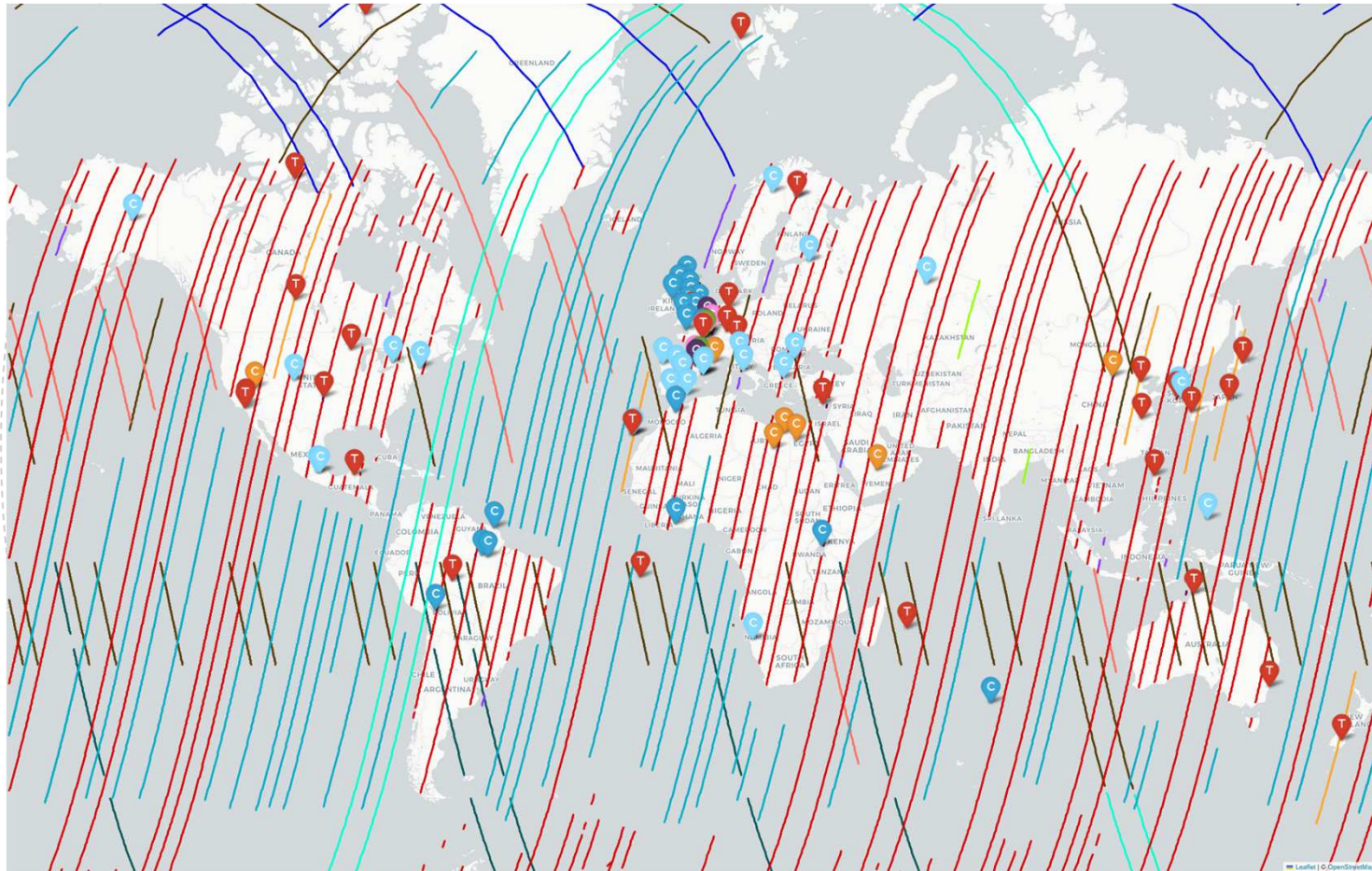


- A **Scientific Mission** dedicated to natural CO₂ fluxes at global scale & demonstrator for anthropogenic emissions
- Cooperation with **UKSA** and **European Commission**
- Operational processing & distribution to Copernicus users delegated to **EUMETSAT** through Copernicus project

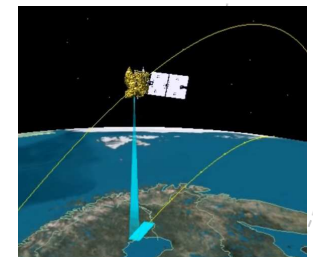
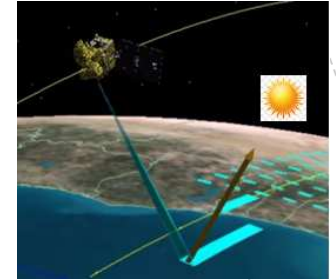
Scientific distribution & validation on
AERIS/DATA-TERRA



All Mission Acquisition modes are tested



- ✓ CALDARKINS
- ✓ CALDARKO
- ✓ CALLAMP
- ✓ CALOFFNADIR
- ✓ CALSUNORB
- ✓ CALSUNPPRES
- ✓ CITY
- ✓ FIXTARGET
- ✓ GLINT
- ✓ INTERCITY
- ✓ MISOFFNADIR
- ✓ NADIR



T = TCCON site
C = Other CALVAL site
(EM27/SUN, deserts, SIF tower)

ORBITS 16/10/2025 – 22/10/2025

• FIRST ACQUISITION ON AUGUST 28th 2025 😊

✓ CLOUDS-FREE AREA ABOVE AMAZONIA (confirmed by S2)

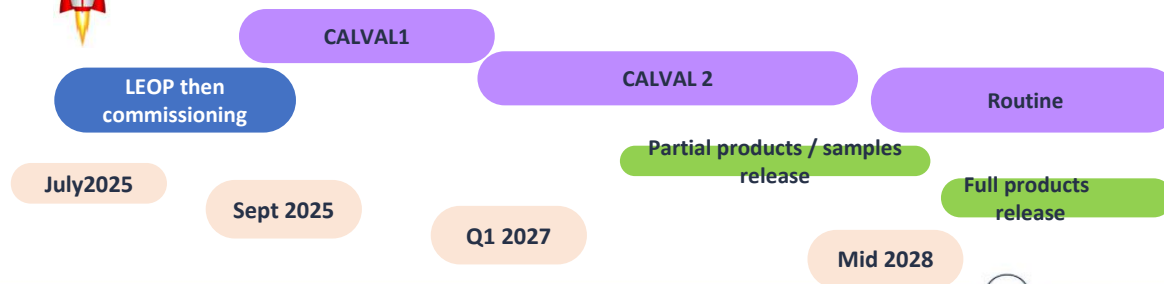
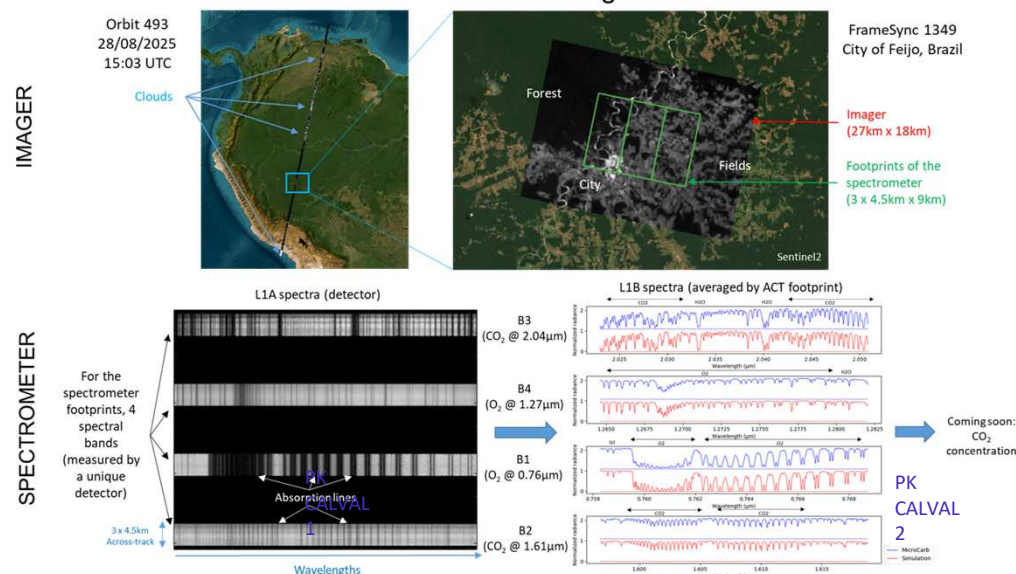
✓ FIRST CALIBRATED SPECTRA (in comparison with simulation 4AOP)

• Q4 2025, Anomaly with **recurrent Ice contamination** on detectors which affect transmission & straylight

⇒ CNES is still investigating decontamination strategies to remove the water and to develop straylight correction algorithms

⇒ impact on the CALVAL schedule & release of products to the community

MicroCarb first light



Processing & diffusion of MicroCarb products on AERIS DATA Terra for SCIENTISTS

MicroCarb science products (L1, L2, L3)

- L1B, L1_ISRF, L1C : Images and spectra (FOV level)
- L2_STD, L2_DIAG : raw results from 4ARTIC, no bias correction
- L2_LITE, L2_FLUO (main products of the mission) : raw and bias corrected results
- L3

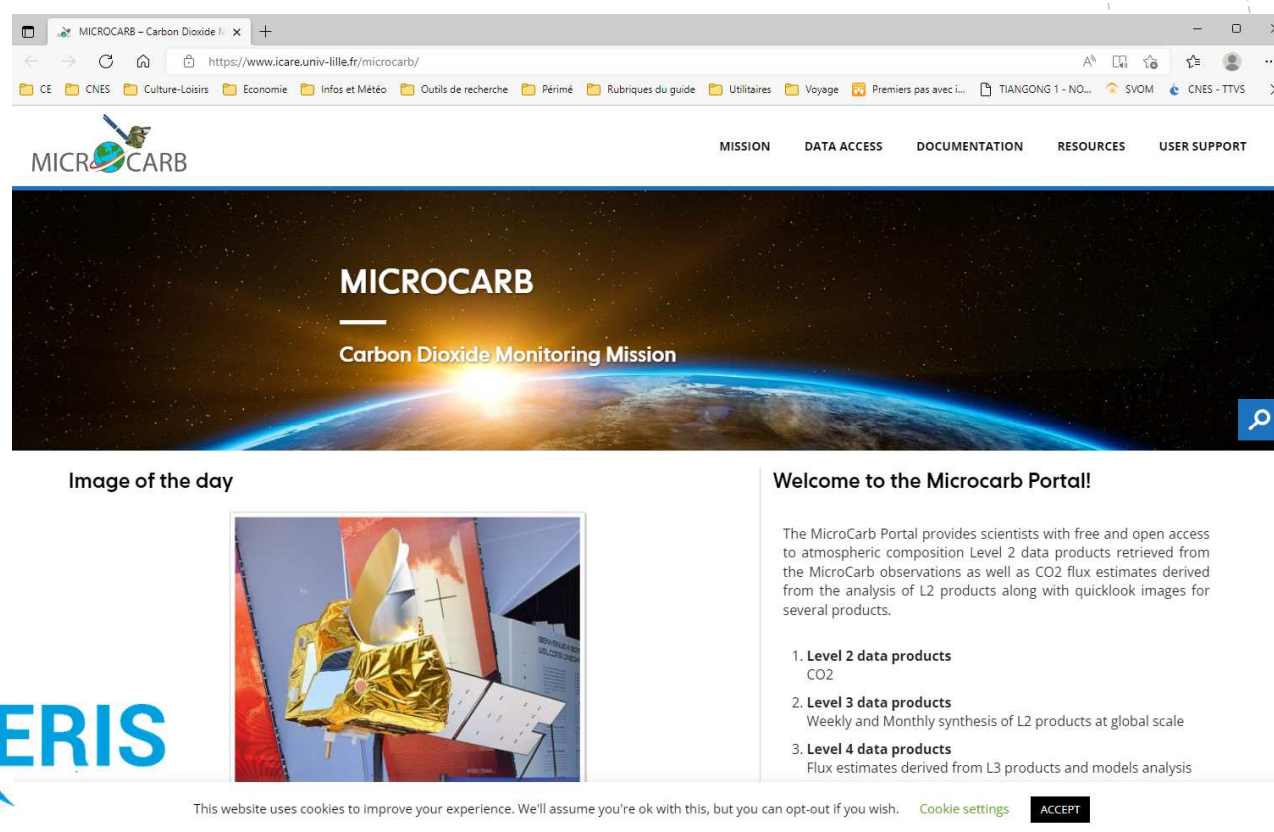
All products will be in netCDF,

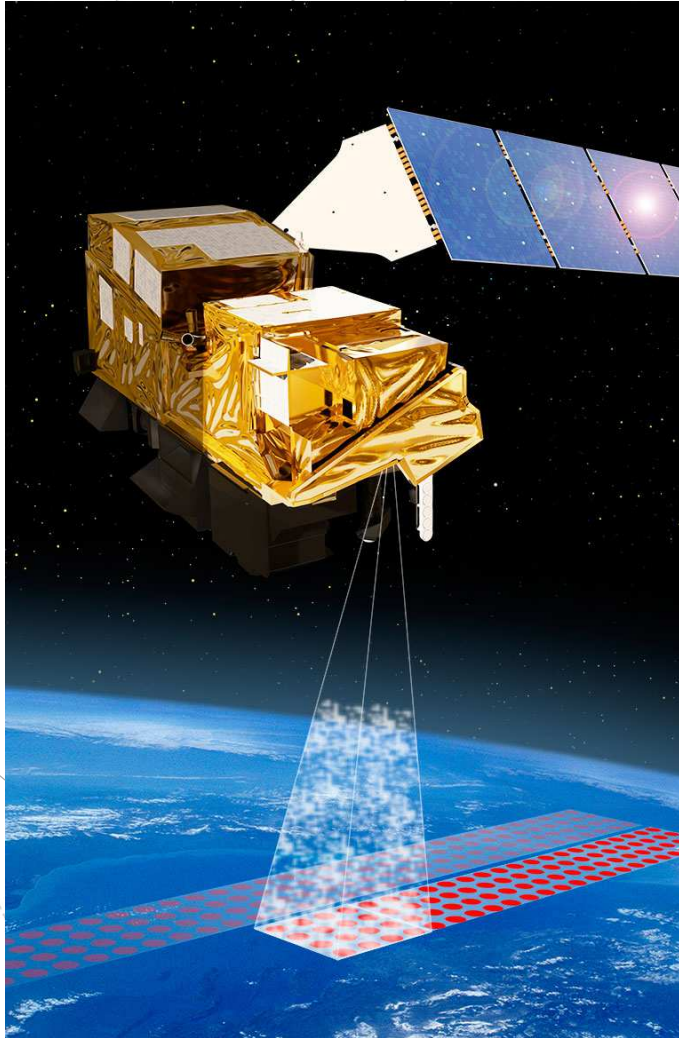
The Fluxes (L4) will be prepared by users.

- Rapid update of products version
- Frequent reprocessing



- <https://microcarb.aeris-data.fr/>





IASI>NG

**Succesfully launched on
MetOp-SG-A1, with
Copernicus Sentinel-5, 3MI,
.. with Ariane 6 rocket
Kourou, French Guiana, on
12 August 21:37 local time).**



From IASI to IASI NG, the success story !



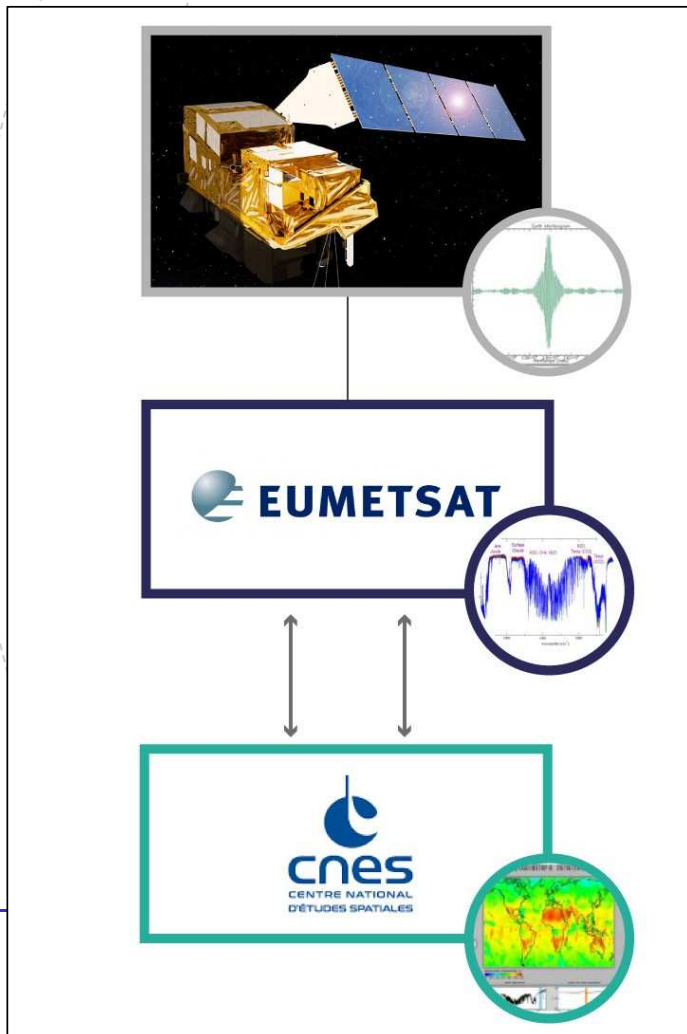
IASI>NG



After the IASI cooperation started in 2001, EUMETSAT continue the cooperation with CNES in the frame Polar System Second Generation programme with an agreement in December 2015 for:

- ✓ CNES (and ADS) development of 3 instruments to be embarked on Metop-SG A1/A2/A3 satellites (among 6 instruments: 3MI, S5, METImage, RO, MWS)
- ✓ CNES development of an operational processing chain to generate L1C user products operated by EUMETSAT
- ✓ A Centre of Expertise (IASTEC) for Flight Performance Monitoring and Parameter Update, operated by CNES Toulouse.

=> IASI NG is defined with the same pixel size than IASI (12km D) and spectral TIR domain but with a SNR and a spectral resolution better by a factor 2





IASI-NG MISSION OBJECTIVES (2x 2 Better than IASI)



IASI-NG



- **Numerical Weather Prediction**



Temperature



Water Vapour

- **Atmospheric composition**



Aerosols



Pollutants

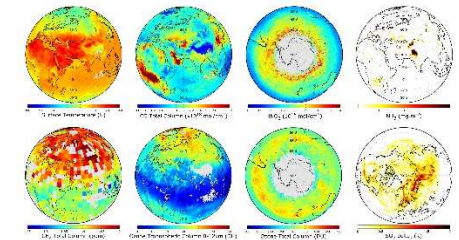
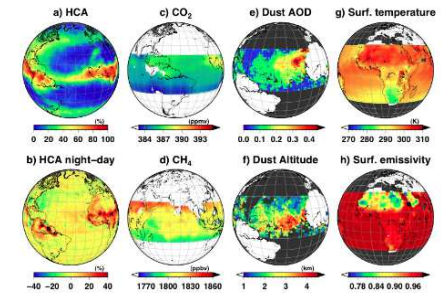


Nuages volcanics Ashes

- **Climate**



Greenhouse gas, ECV Trends
IR radiative budget , SST



IASI Lessons Learned:

- ✓ **3 communities** more and more connected (Copernicus, ECVs, GEOSS)
- ✓ Covering continuously the **whole TIR domain** is very useful in complement to S5 (UV Vis)
- ✓ several variables simultaneous retrieved (cloud, T, WV and more than 30 species)
- ✓ Unique for Retrievals **over land/sea by day/night**.

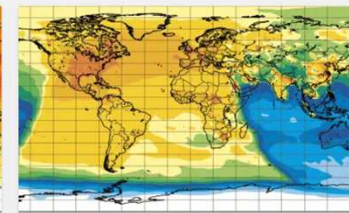
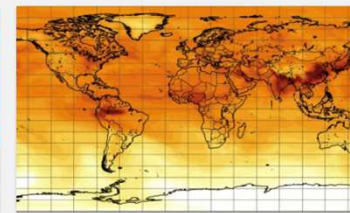
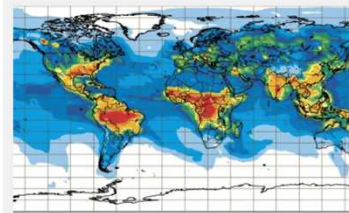
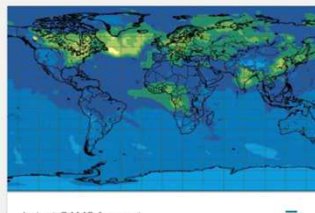
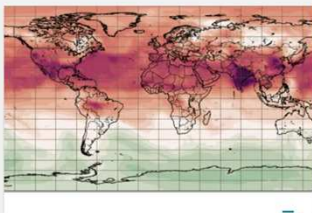
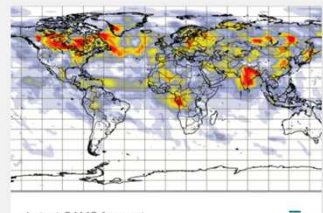
Thanks to its exceptional spectral and radiometric stability, and the continuous work done by CNES, EUMETSAT and the labs, **IASI has been selected as the reference instrument for thermal infrared** by the WMO-GSICS program. → **Expectation is**

high for IASI-NG 😊



IASI & Copernicus Services list of IASI products used by CAMS and C3S ☺

Service	Status	Product	Algorithm	Processing team
CAMS   	Assimilated in NRT	CO₂ & CH₄	NLIS (LMD)	LMD/FX-Conseil
		CO, SO ₂ ,	FORLI & Other (LATMOS/ULB)	EUMETSAT AC-SAF
	Distributed in NRT for future assimilation	O ₃ , NH ₃	FORLI & Other (LATMOS/ULB)	
C3S  	6 month release	CO₂, CH₄	NLIS (LMD)	LMD/FX-Conseil
	Annual release	O ₃	FORLI (LATMOS/ULB)	LATMOS/ULB
		Dust (AOD and/or height)	LMD, ULB, BIRA, DLR	LMD/FX-Conseil, ULB, BIRA, DLR
CCI+ (ESA)		CO	LATMOS/ULB	
		CFCs		
		N₂O	LAERO	

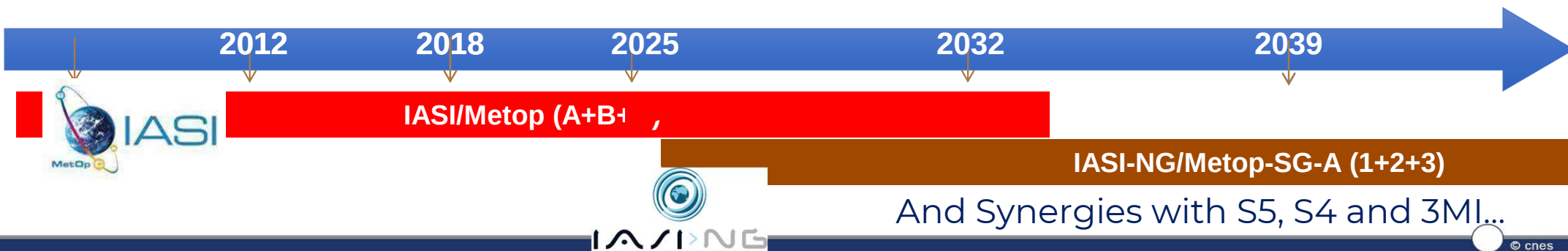




A new age for Atmospheric Science, Climate and Meteorology



- IASI is a key (and historic) contributor to Copernicus services, demonstrating that:
 - NRT processing, data delivery and operational activities now go far beyond classical NWP activities.
 - Regular reanalysis are needed to enable climate monitoring at the required precision.
- Strong implications on L1 and L2 monitoring and validation!
- Since June 5th 2026, data are distributed to the scientists involved in the project thanks to French AERIS database connected to the Eumetsat Datastore**



MAGIC-AVALON - Airborne VALIDation Of New-generation satellites

A 1-month campaign led by CNRS-LMD



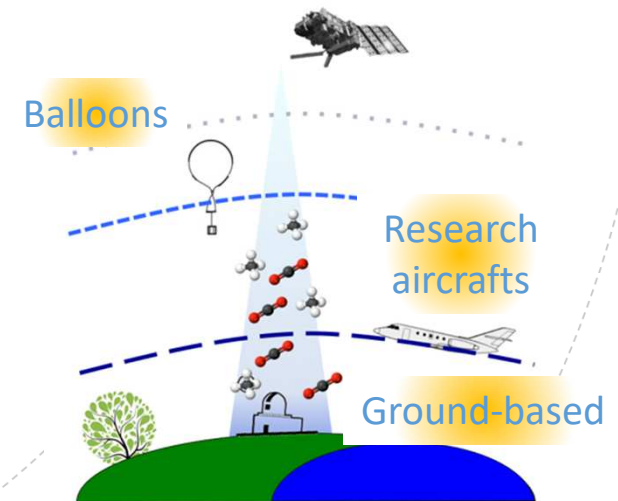
- Three scientific objectives:
 - **SO1: Validation of Metop-SG (IASI-NG, 3MI, Sentinel5), MTG-S (IRS, S4) and MicroCarb**
 - **SO2:** Estimation of anthropogenic emissions (industries, agriculture) of gases and particules
 - **SO3:** Preparation of future space missions (CO₂ lidar SCALE, ECO/EE12, NitroSat/ex-EE11)
- **Date: 1-27 June 2026**
- **Location: France-Belgium**
- **Team:** 20 European teams (Fr, B, G, UK, Swiss, Canada) >90 participants
- **Funding:** CNRS, CNES, ESA, EUMETSAT, BELSPO



- **How:** By combining measurements from **aircrafts**, **balloons** and **ground**, both in-situ and remote sensing, to extensively characterize the atmosphere at the overpassing time of the **satellites**
- **Main targeted products:** Temp, H₂O, O₃, CO₂, CH₄, CO, N₂O, NO₂, NH₃ + aerosols
- Builds on past MAGIC campaigns (2018-2023) and AirCore-Fr network



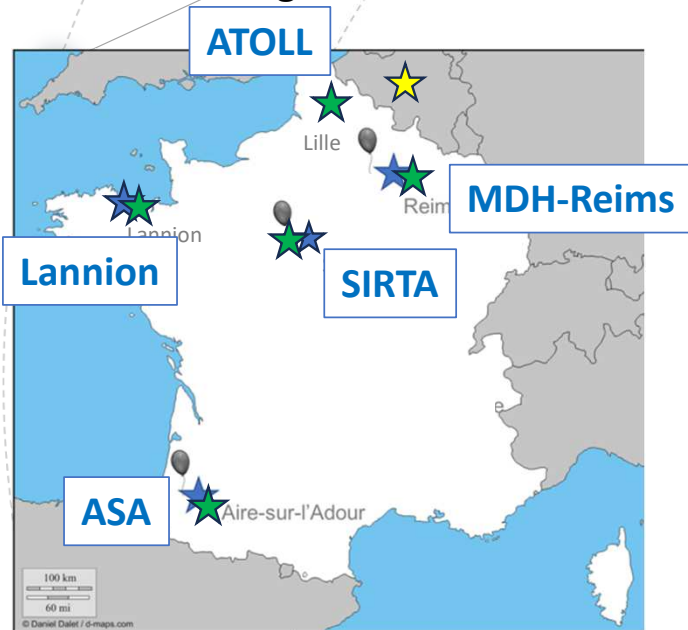
<https://magic.aeris-data.fr/magic-avalon/>



MAGIC-AVALON - Airborne VALidation Of New-generation satellites



Balloons and ground-bases sites



- ★ Balloons (AirCore) at 4 sites
- ★ Supersites (lidar, EM27/SUN)
- ★ Mobile ground-based instr.

→ Balloon launch at each overpassing time of Metop-SG-A1 during one month

=> Sites also for inter-comparison with Japanese and US missions & soon with Chinese GHG satellites

SAFIRE ATR42



3 research aircrafts

DLR Cessna



SFS Tecnam



Passive analyzers



SPIRIT@LPC2E



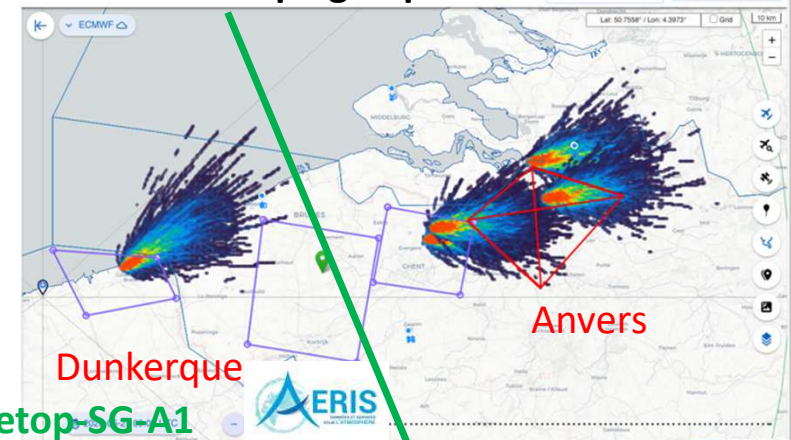
IAGOS bay@LAERO



SCALE@CNES

NH₃ Telops Hyper-Cam@ULB

AERIS Campaign operational site



Metop-SG-A1

Thanks for your attention

CNES.FR

