

CNES EARTH OBSERVATION MISSION REPORT

F. BERMUDO • IASI-NG PROJECT MANAGER • CNES

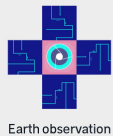
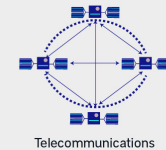
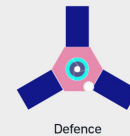
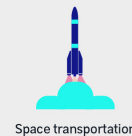
INTERNATIONAL TOVS STUDY CONFERENCES, ITSC-25 GOA, INDIA
MAY 8, 2025 – MAY 14, 2025

CNES by the numbers



+100 space projects

Currently led by CNES in 5 key domains.



THE CENTRES

2,350 employees working in four different centres



OBSERVATION

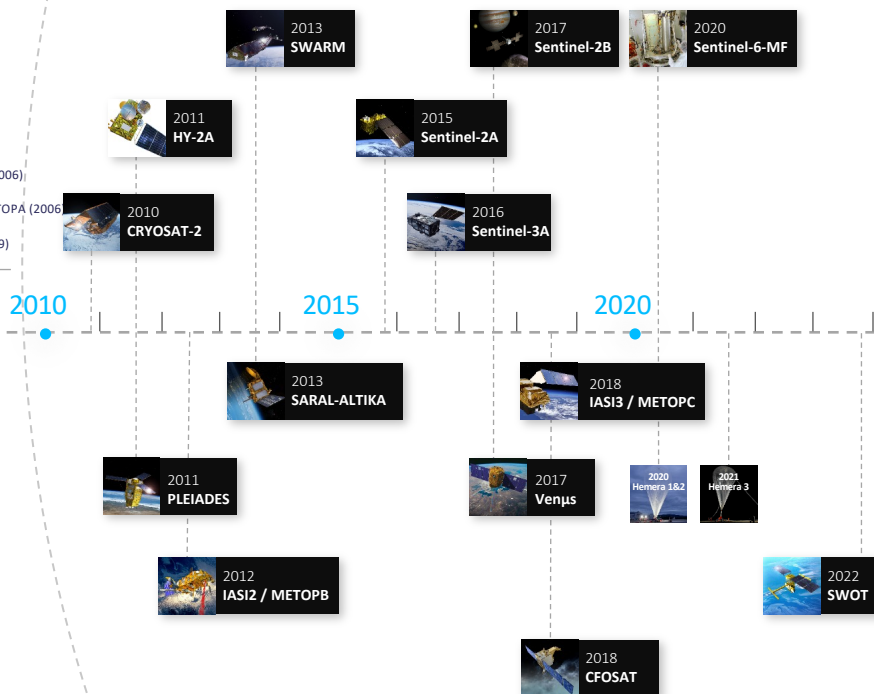
PROGRAMMES IN OPERATION



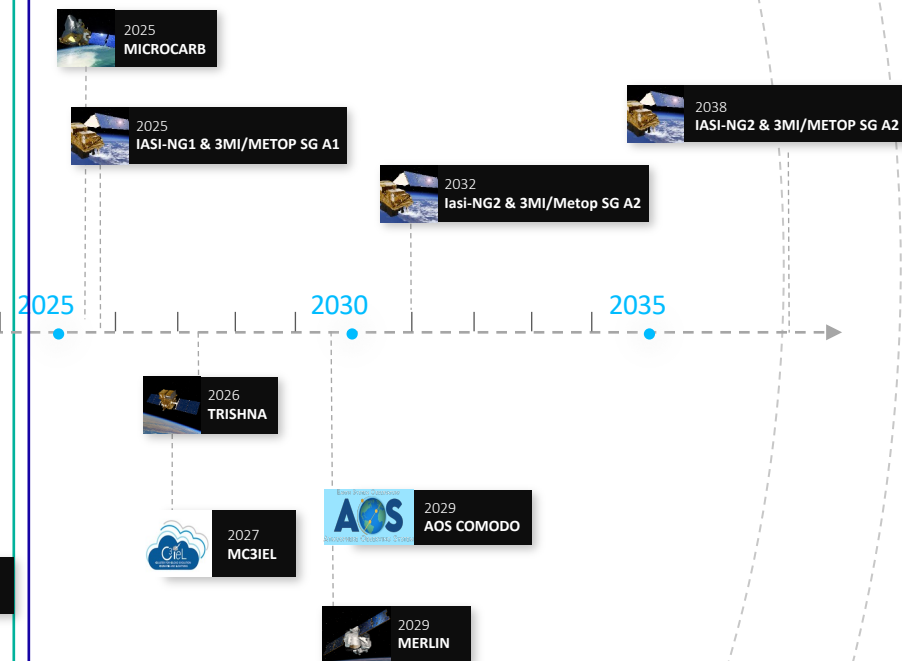
CALIPSO (2006)

IASI1 / METOP A (2006)

SMOS (2009)



PROGRAMMES IN DEVELOPEMENT



IASI-NG



NUMERICAL
WEATHER PREDICTION



ATMOSPHERIC
CHEMISTRY



CLIMATE MONITORING



Metop-SG-A1
Module de vol 1



Metop-SG-A2
Module de vol 2



Metop-SG-A3
Module de vol 3

2025

2032

2039

PROGRAMME STATUS

- IASI-NG FM2 instrument integrated onboard MetOp SG A1 satellite
- Launch campaign in CNES Guyana Space Center in June 2025
- Launch with Ariane 6 Mid August 2025
- In Orbit System Validation Completion November 2025
- Calibration/Validation phase completed Mid 2026

IASI-NG PROGRAMME

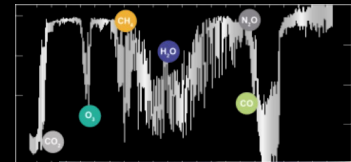
- 3 instruments embarked onboard Satellites MetOp-SG A1/A2/A3
- Level 1 Operational Processor (L1CPOP) in charge of processing data up to level 1C operated by EUMETSAT
- Technical Expertise Center (IASTEC), in charge of performances monitoring in Orbit operated by CNES.



INNOVATION

1st implémentation of Mertz Interféromètre in Space programm

Improvement of a factor 2 of Spectral Resolution and Radiometric Performances (NedT) Vs 1st generation



PARTNERS

- EUMETSAT : in charge of EPS SG System
- UK SA, NSC et SSO : bilatéral coopération on the Instrument
-

INSTRUMENT

- 1,296,000 spectres per day
- Field of view 2000 km
- 4 spectral bands
- Active cooling of detectors
- Mass: 430 kg



INSTRUMENTS NAME

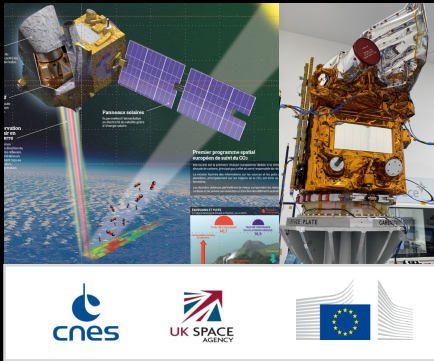
During the **december 2024 IASI conference** a vote was conducted to select the **names of the 3 instrument**.

- Penelope for PFM
- Francisco for FM2
- Fiona for FM3





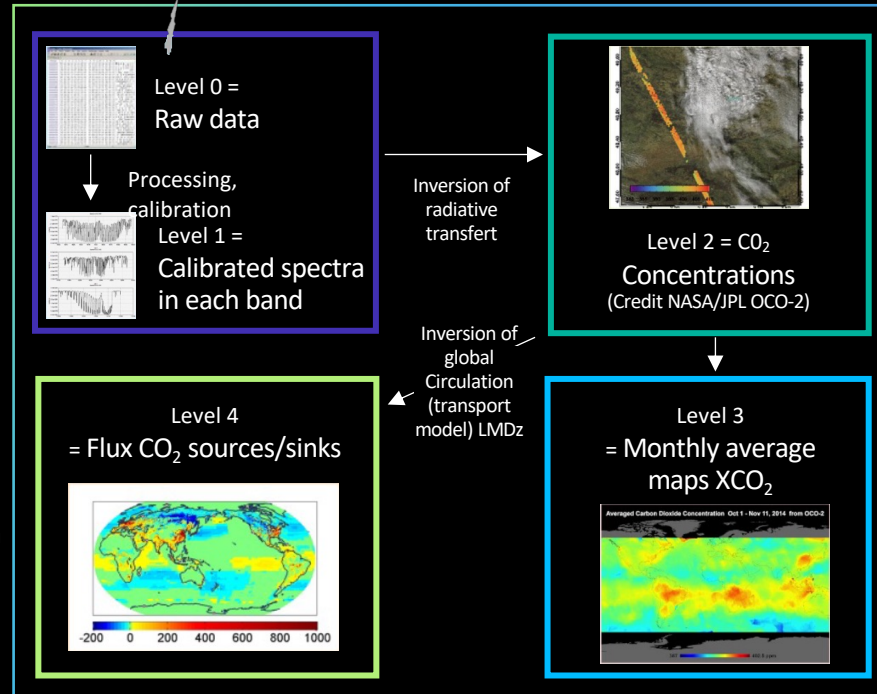
MicroCarb is designed to map sources and sinks of carbon dioxide (CO₂) on a global scale.



INSTRUMENT

- Grating spectro imager,
- 2 CO₂ and 2 O₂ bands on a single detector
- passive cooling to 160 K
- 80 kg, 60 W instrument

- Mission center developed by CNES then housed and operated in EUMETSAT through a European Union – ESA cooperation agreement
- 180 kg Microsatellite based on an upgraded Myriade platform (19th Myriade platform since 2004)
- Launch: planned in July 2025 on VEGA-C
- 650 km 22h30 sun synchronous orbit
- Expected lifetime: 5 years

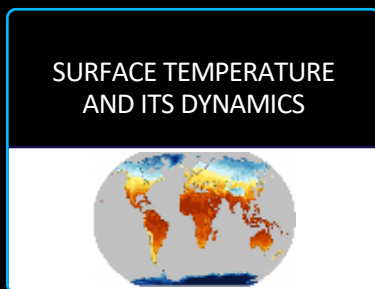


TRISHNA

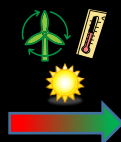
Towards innovative infra-red data for environmental monitoring mission overview



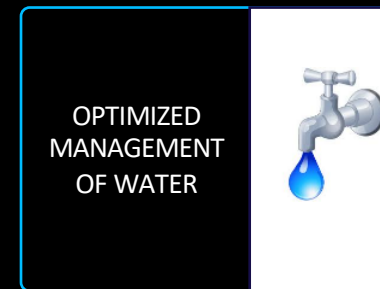
ISRO/CNES COOPERATION



FREQUENT AND HIGH-RESOLUTION MEASUREMENTS

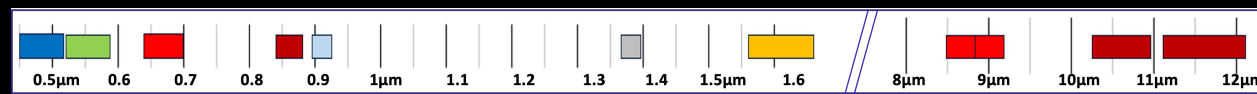
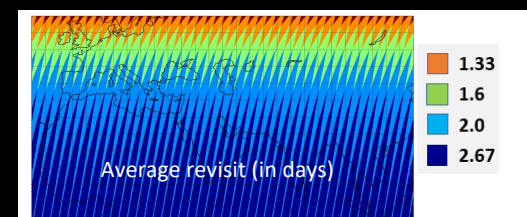


- EVAPORATION OF WATER FROM SOILS
- TRANSPIRATION OF PLANTS
- LOCAL CLIMATE



ISRO PLATFORM

- Design drivers: ecosystem stress and water use; coastal & inland waters
- Global coverage land + coastal
- 3-day revisit, 60m ground resolution
- Launch in 2026 with ISRO PSLV launcher



SPECTRAL BANDS, VISIBLE



SHORT WAVE INFRARED



THERMAL INFRARED

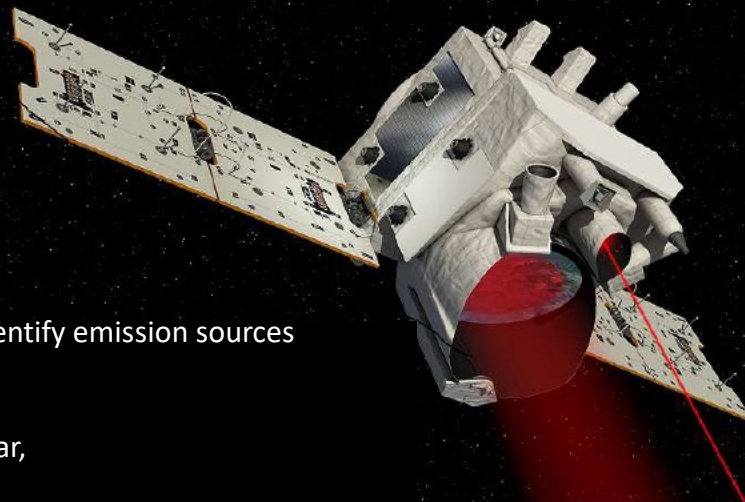


Merlin : Methane Remote Sensing Lidar

Mission



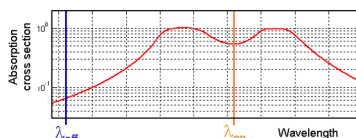
© CNES/illustration David DUCROS, 2016



- Measure methane concentrations in Earth's atmosphere and identify emission sources
- CNES and the German space agency DLR Cooperation
- 430 kg: satellite mass
- 1 instrument: Integrated Path Differential Absorption (IPDA) lidar,
- 50-km horizontal resolution
- 2028: Scheduled launch of MERLIN

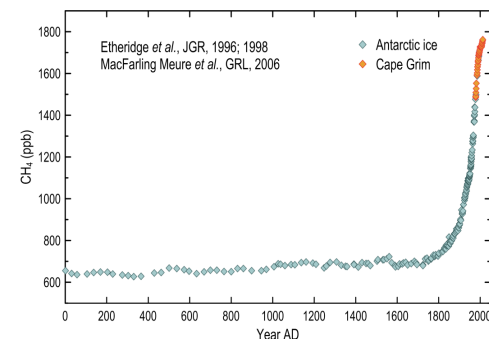
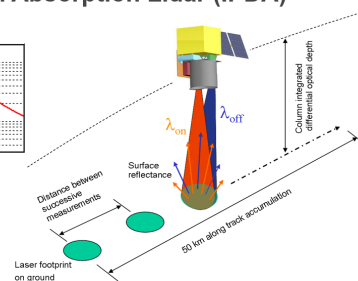
French German Cooperation
Active measurement through a Lidar
based instrument

MERLIN measurement principle: Integrated Path Differential Absorption Lidar (IPDA)



CH₄ IPDA

pulsed laser transmitter one on-line
and one off-line wavelength



C²OMODO

The french contribution to atmosphere observing system (aos) program led by nasa to characterize aerosols, clouds and precipitations

- C²OMODO (Convective Core Observations through MicrOwave Derivatives in the trOpics)
 - Based on a tandem of microwave radiometers aboard C²OMODO-Sat (NASA) and PMM (JAXA)
 - To observe deep convection in order to monitor and characterize storm formation
- For meteorological and air quality forecasting, for climate change assessment
- 2 Microwave Radiometer and Operational processing chains for level-1 products provided by CNES to NASA and JAXA mission centers
- Expertise center at CNES for instrument and data monitoring
- Co-launch of C²OMODO-Sat and PMM scheduled in March 2030

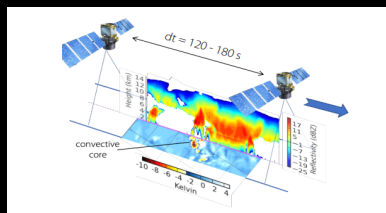
AOS-Storm

- two observatories flying in formation making coordinated measurements
- single, combined NASA-provided launch
- inclined low Earth orbit

@NASA



*CNES-provided microwave radiometers operating in tandem constitute C²OMODO (Convective Core Observations through MicrOwave Derivatives in the trOpics)



C²OMODO,
A TRILATERAL ORGANIZATION

C3IEL

Cluster for Cloud Evolution, ClimatE and

Lightning

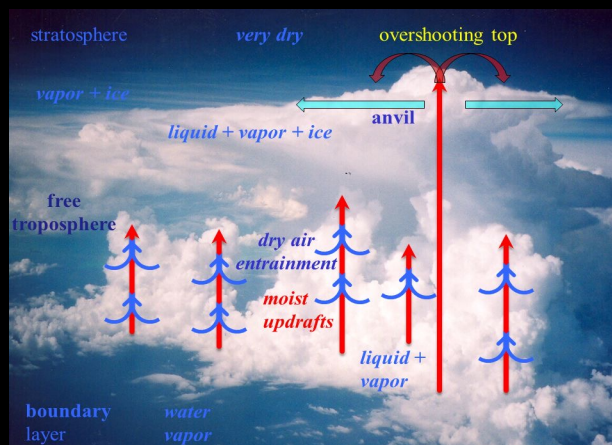
UNDERSTANDING GROWTH AND ORGANIZATION OF CONVECTIVE CLOUDS

- A joint mission of the French (CNES) and Israeli (ISA) space agencies
- A train of two nanosatellites synchronized to observe the same cloud scene from different angles
- Main French research laboratories:

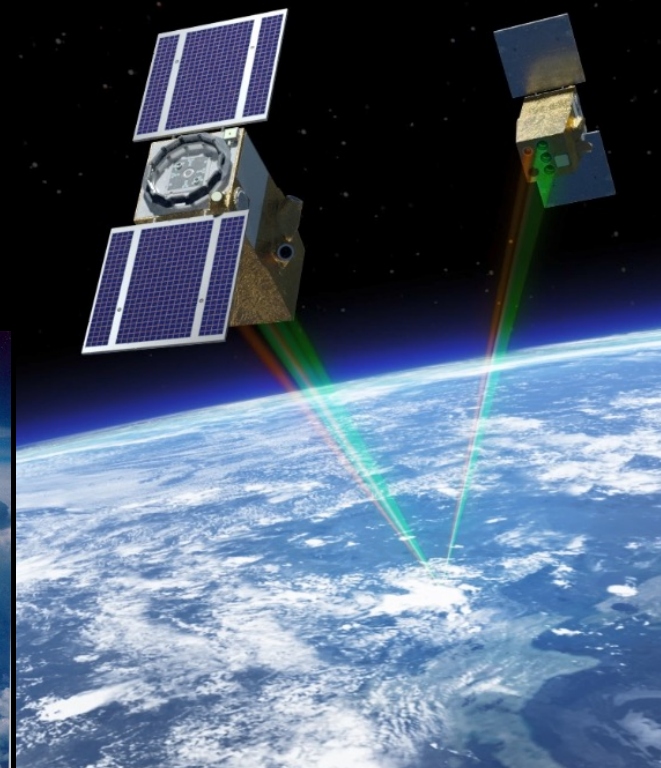
Laero
Laboratoire d'Aérodynamique



- Launch date Planned 2028.



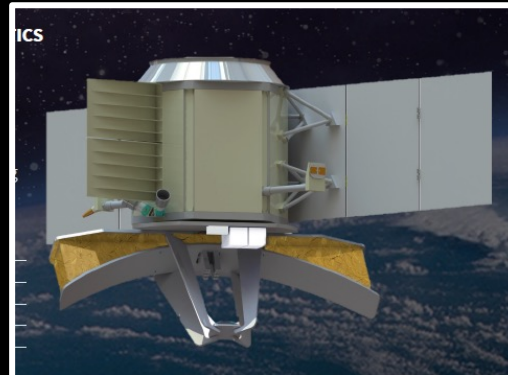
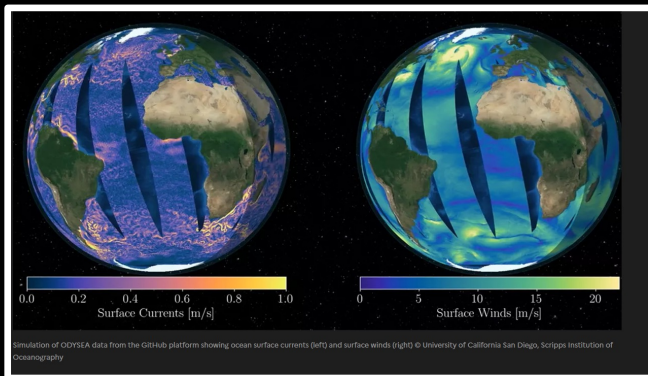
ALTITUDE :
[540 KMS, 650 KMS]
SSO (SUN SYNCHRONOUS ORBIT)
LTAN : 13:30



ODYSEA

Ocean dynamics and surface exchange with the atmosphere

- French-U.S. mission proposed by the Jet Propulsion Laboratory (JPL) and CNES for NASA's Earth System Explorers Announcement of Opportunity (AO).
- ODYSEA's objective is to study ocean surface winds and currents at fine scale
- 1500km wide field of view rotary Doppler diffusiometer using the Ka band
- If the ODYSEA mission concept is selected by NASA as one of the two ESE missions in November 2025, it will progress to phases B, C and D
- Launch of ODYSEA satellite 2030



CARIOQA

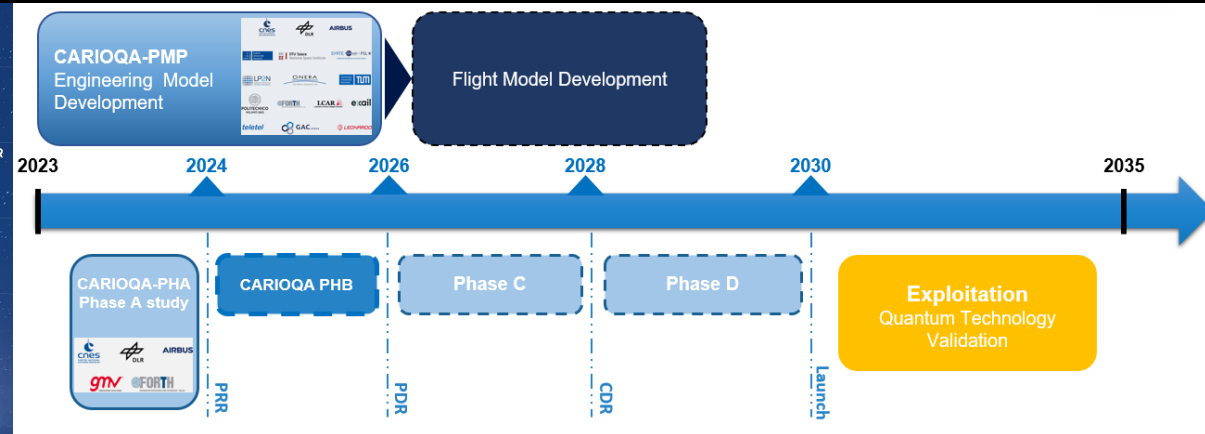
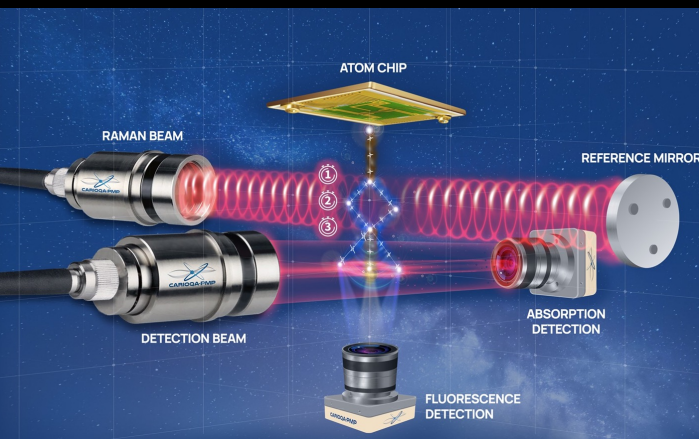
PHASE A/B

Develop and launch the first atomic accelerometer on a satellite

Consortium of 16 European partners with 4 French laboratories, CNES as the leading Consortium and in close collaboration with DLR



Funded by the European Union, CNES and DLR



CMIM CONSTELLATION

Constellation of mini sounders for meteorology

- **Objective** → Improving short and medium range Numerical Weather Prediction (NWP) by 2030 – 2035.
- **Means** → Densifying temperature and water vapor observations in lower layers of the atmosphere by increasing revisits of Infra-Red (IR) and/or Micro- Wave (MW) instruments.
- phase 0 ON GOING to assess the **technical feasibility** and the **scientific interest** of a constellation of mini sounders with IR and MW payloads at **high spatial** (close few km) and **temporal** (close few hours) resolution by 2035, to assess requirements for NWP improvement

Constellation architecture :

- 8 satellites with sun-synchronous orbits (SSO).
- 4 orbital planes (2 sats/plane), altitude : 630km
- Finalizing of Phase 0 in june 2025 to move to Phase A to define the (Best technical solutions: IR-agile, Mixed IR+MWLF) and Technical developments that shall be anticipated (IR detectors, RF numerical electronics,)
- A dialogue with Eumetsat has been initiated and also with an objective to check if the CMIM concept can meet other needs than NWP

PHASE 0 AT CNES

