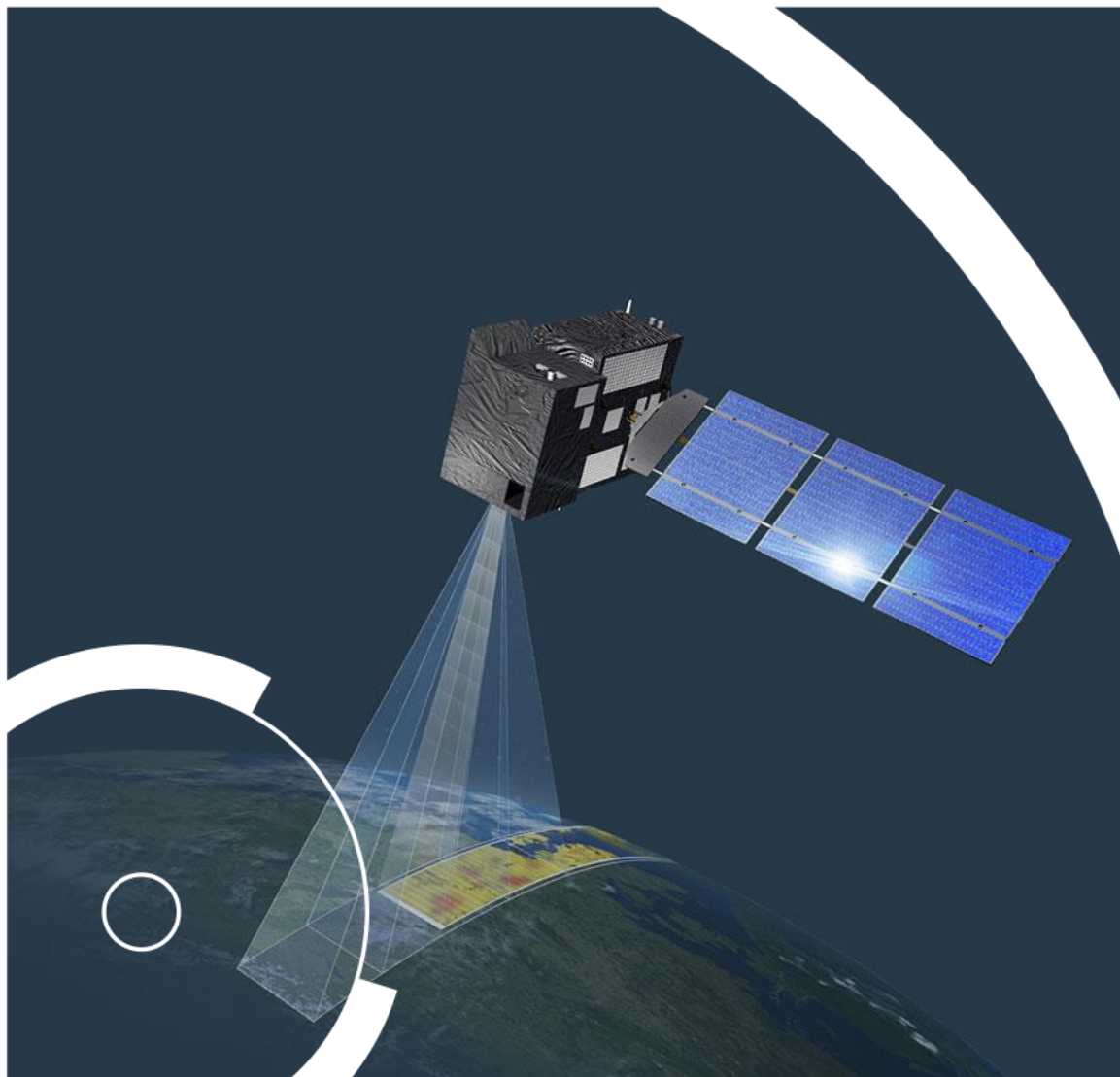




CO2M status and results from developments

TCCON/COCCON annual meeting
16 June 2025

Ruediger Lang (EUMETSAT), Yasjka Meijer (ESA), Maurizio De Bartolomei, Helmut Bauch, Bojan Bojkov, Leonid Butenko, Hannah Clarke, Paola Colagrande, Josef Gasteiger, Catherine Hayer, Bernd Husemann, Thomas Honig, Antoine Lacan, Fabrizio Di Loreto, Thierry Marbach, Pepe Phillips, Cosimo Putignano, Vincenzo Santacesaria, Sruthy Sasi, Bernd Sierk, and Eduardo Valido Cabrera

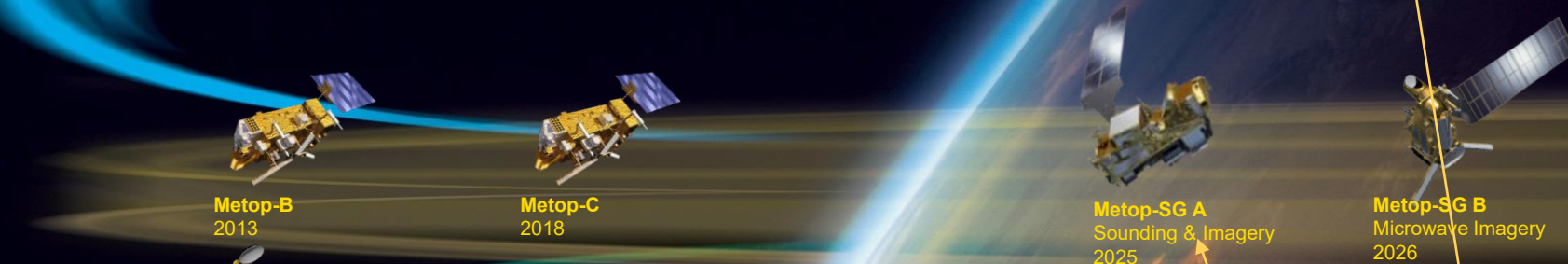


EUMETSAT missions – *current and future*

Geostationary Programmes



Polar Programmes



Third Party Programmes (incl. Copernicus)





EUMETSAT missions – *current and future*

Geostationary Programmes

Meteosat-9
2006

Meteosat-10
2013

MSG-4 / Meteosat-11
In-Orbit Storage 2016
Prime Satellite 2018

MTG-I
Imagery
Dec. 2022

MTG-S
Sounding
2025

Launch : July 2025

Launch: August 2025

Launch: 2026

Polar Programmes

Metop-B
2013

Metop-C
2018

Metop-SG A
Sounding & Imagery
2025

Metop-SG B
Microwave Imagery
2026

QAR/FAR: Q3/4 2027

Third Party Programmes (incl. Copernicus)

JASON-2
2009

Sentinel-3A
2016

JASON-3
2016

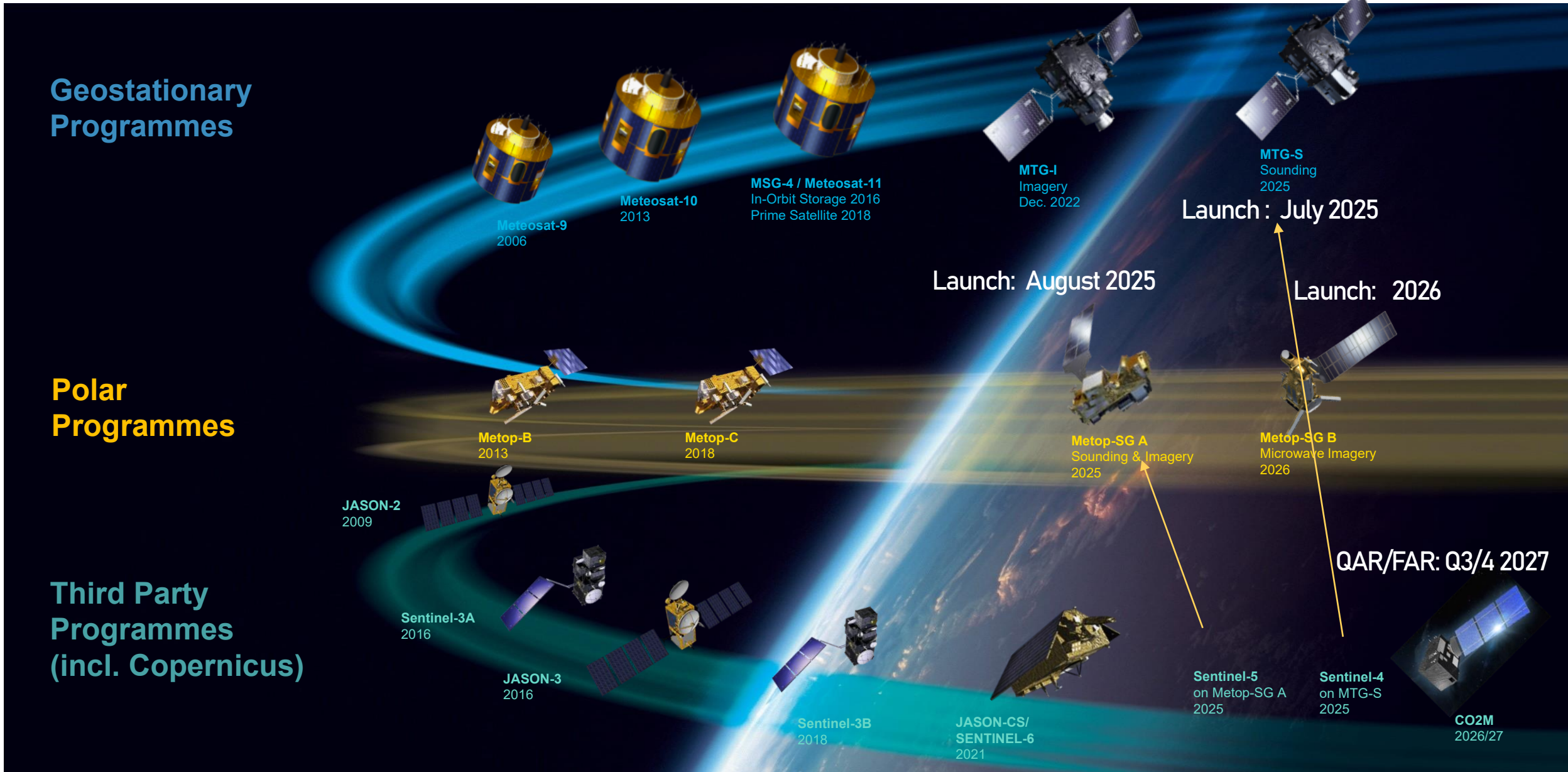
Sentinel-3B
2018

JASON-CS/
SENTINEL-6
2021

Sentinel-5
on Metop-SG A
2025

Sentinel-4
on MTG-S
2025

CO2M
2026/27





The CO2M greenhouse-gas monitoring constellation



copernicus.eumetsat.int



Three satellite missions each with 270 km swath:

- ✓ Providing greenhouse-gas data for the Copernicus GHG Monitoring and Verification Support capacity

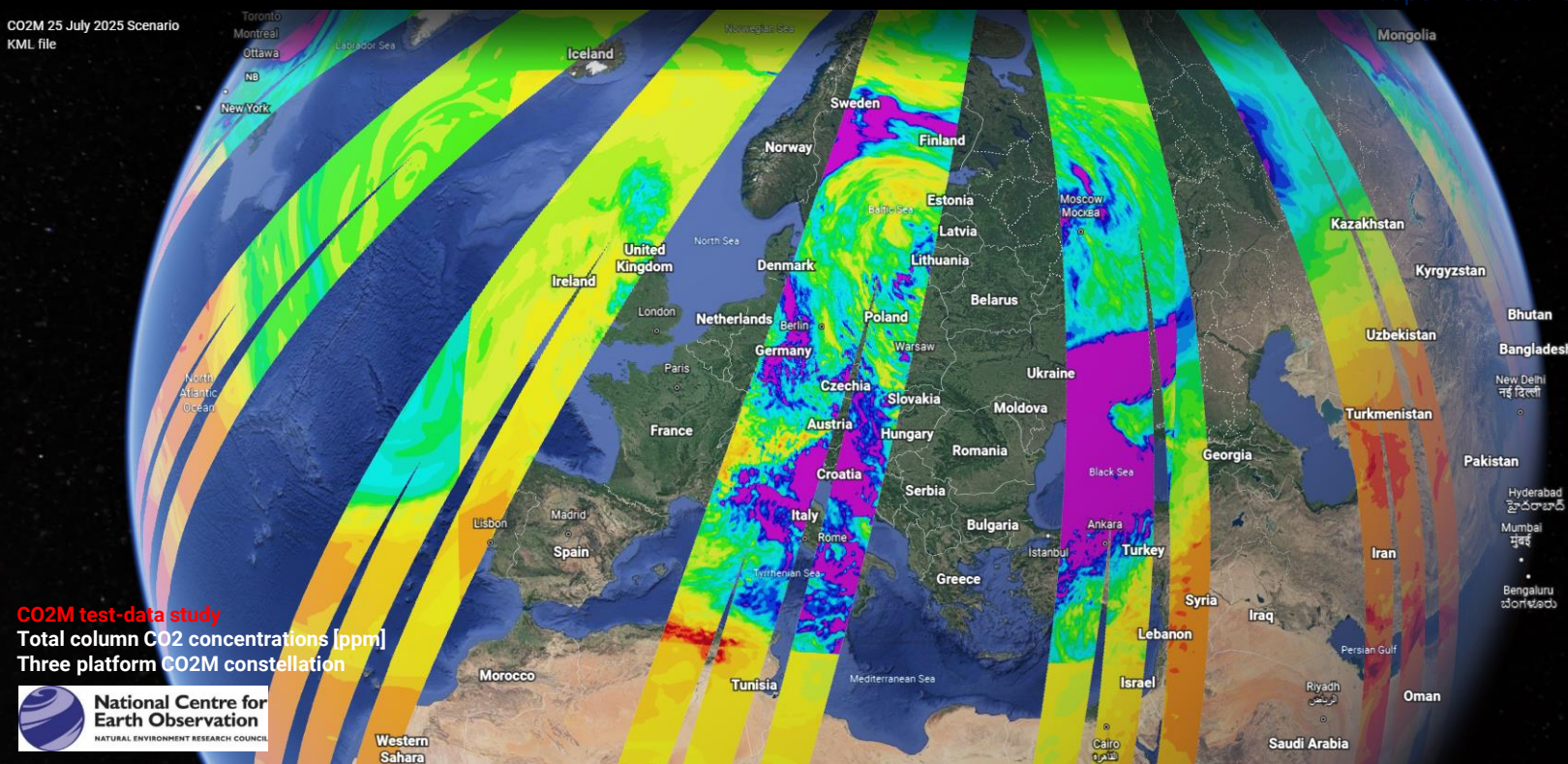
Three instruments per platform:

- CO₂/NO₂ push-broom grating spectrometer (CO₂I/NO₂I)
- Multi-Angle Polarimeter (MAP)
- Cloud Imager (CLIM)

Orbit:

- Sun-synchronous orbit 14 5/11
- 159 orbits repeat cycle (~11 days)
- 735 km altitude
- 11:30 LT
- Platforms in same orbital plane

CO2M 25 July 2025 Scenario
KML file



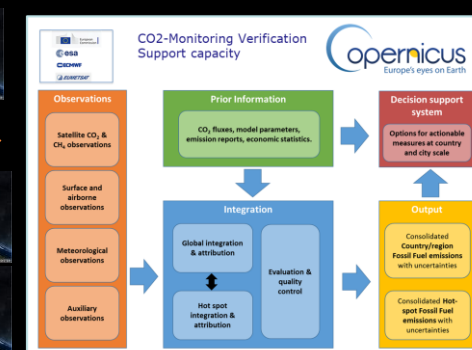
CO2M test-data study
Total column CO₂ concentrations [ppm]
Three platform CO2M constellation



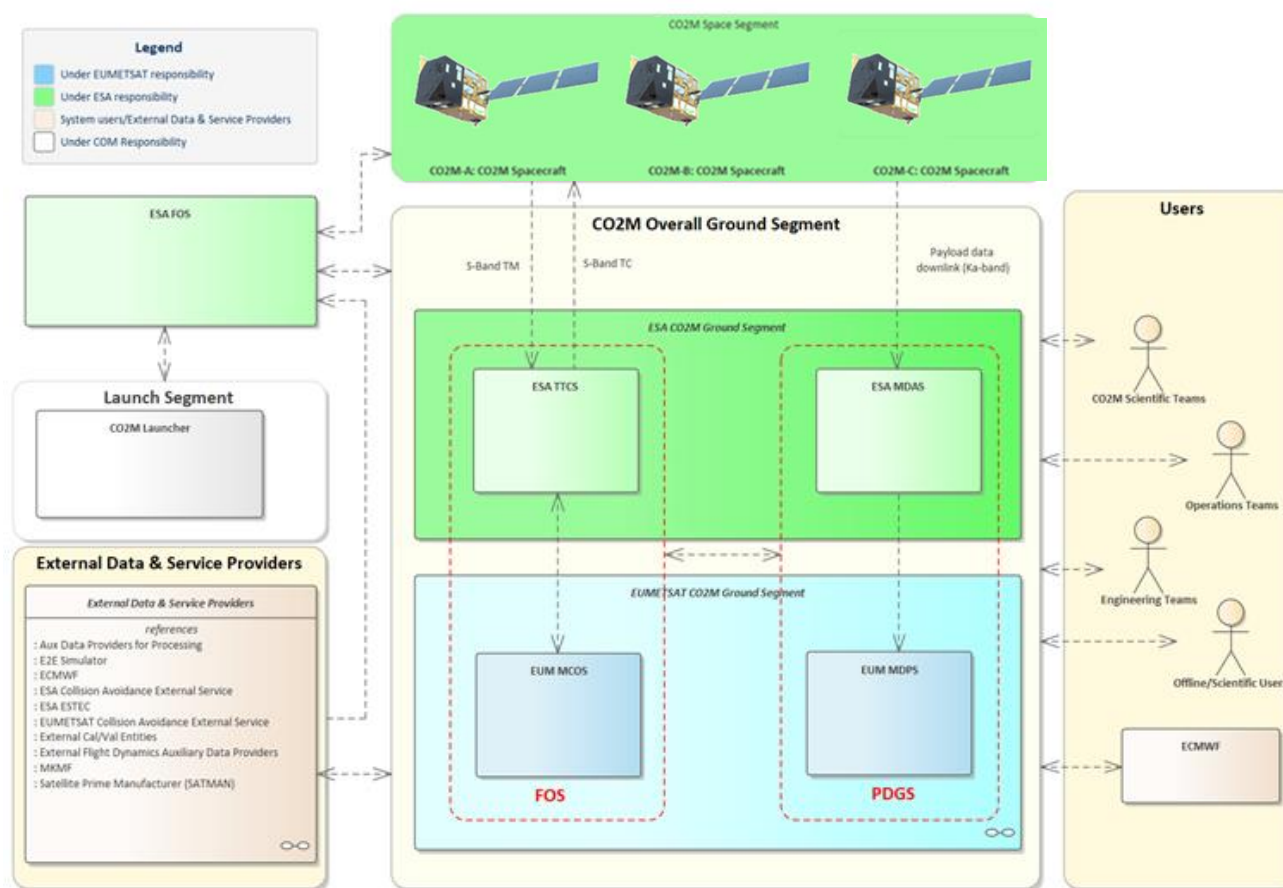
End user products:

Product	Spatial resolution	Precision	Bias
CO ₂	4 km ²	0.7 ppm	<0.5 ppm
CH ₄	4 km ²	10 ppb	<5 ppb
NO ₂	4 km ²	1.5x10 ¹⁵ molec/cm ²	<3.5x10 ¹⁵ molec/cm ²
SIF*	4 km ²	0.7 mW m ⁻² sr ⁻¹ nm ⁻¹	<0.2 mW m ⁻² sr ⁻¹ nm ⁻¹
Aerosols	16 km ²	0.05 AOD, 500 m LH	<0.05 AOD, 500 m LH
Clouds	4 km ²	<1% of FOV	

*Solar Induced Fluorescence



- **ESA is responsible** of the Space Segment development and its commissioning
- **EUMETSAT is responsible** of the development of the operational ground segment (with contributions from ESA) and the CO2M system operations in system commissioning and routine phase.



For payload data (PDGS):

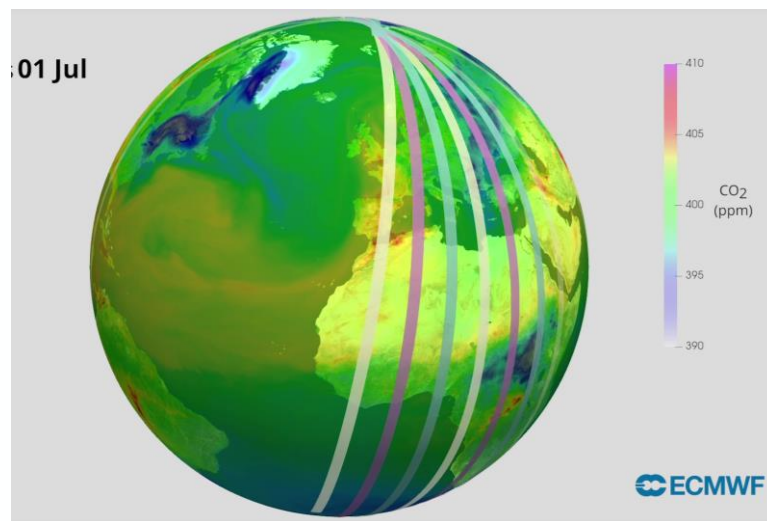
- MDPS (Mission Data Processing Sub-Segment, including: L0/L1/L2 Operational Processors; Archival Dissemination) provided by EUMETSAT;
- MDAS (Mission Data Acquisition Sub-Segment) provided by ESA as a service.

For Flight Operations (FOS):

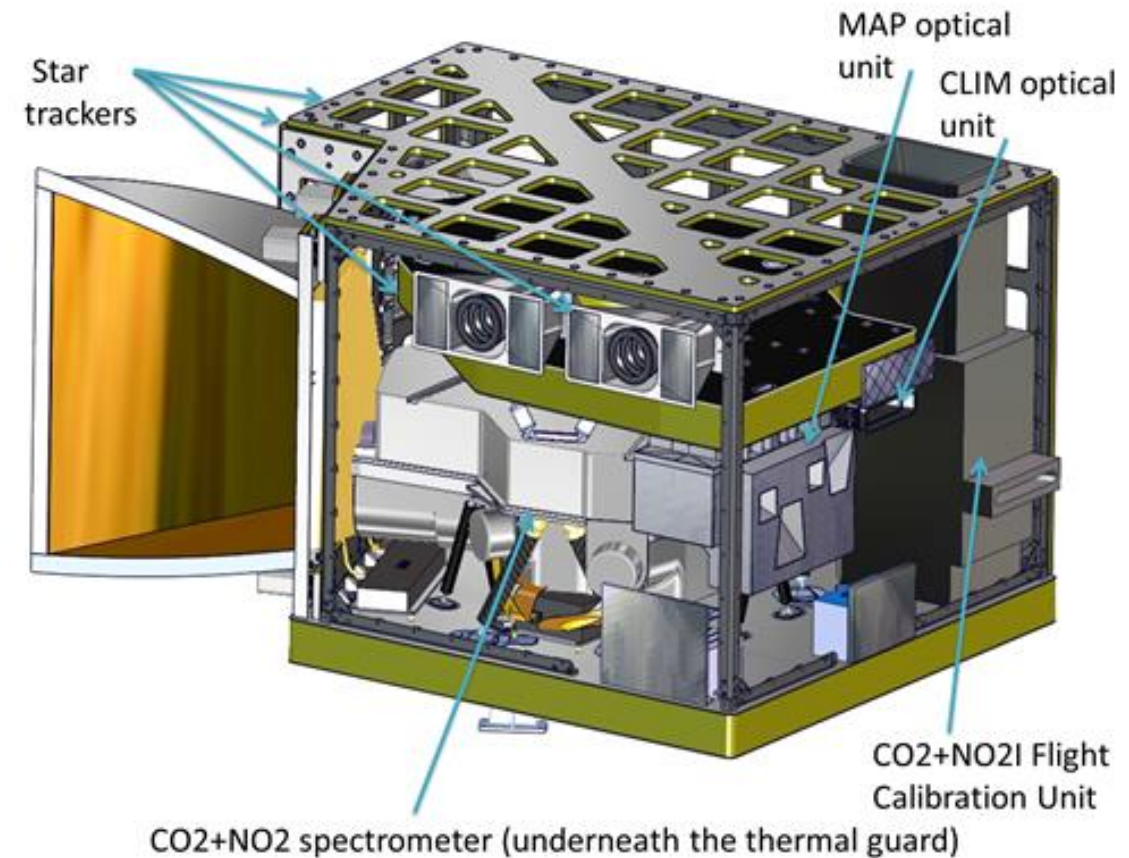
- MCOS (Mission Control and Operations sub-segment, including Mission Planning Facility) provided by EUMETSAT;
- TT&C (Telemetry, Tracking and Command) provided by ESA as a service.

Payload Components

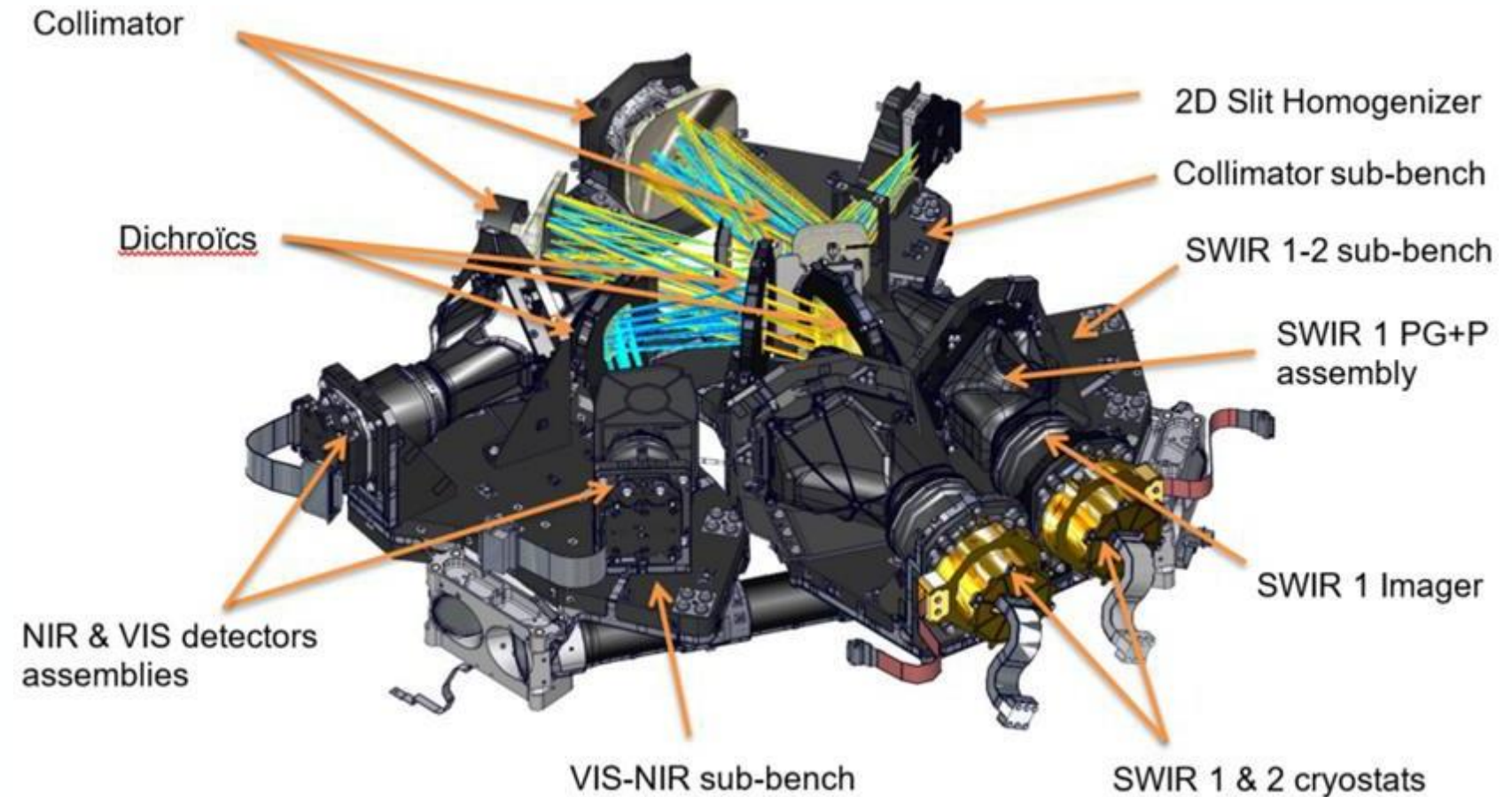
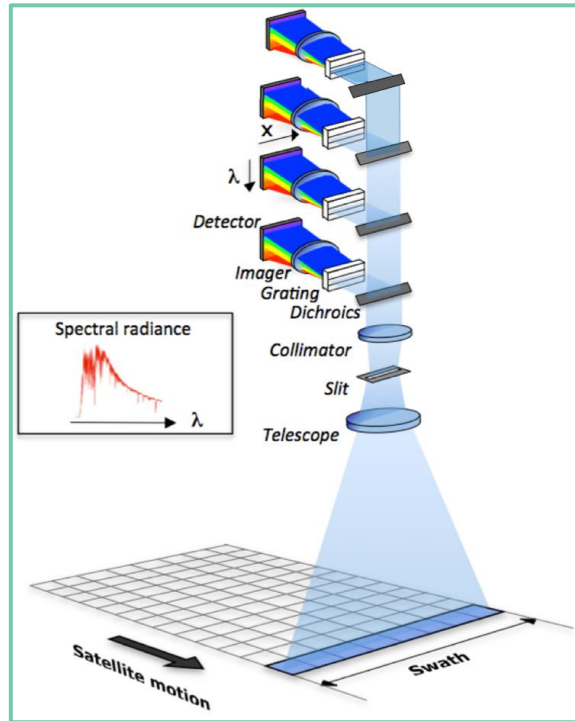
- **CO2 Imager (CO2I)**: 3 band (1 NIR, 2 SWIR) push-broom imaging spectrometer
- **NO2 Imager (NO2I)**: extra band (VIS) in CO2I
- **Multi-Angle Polarimeter (MAP)** for aerosol
- **CLoud IMager (CLIM)** for low cloud & cirrus



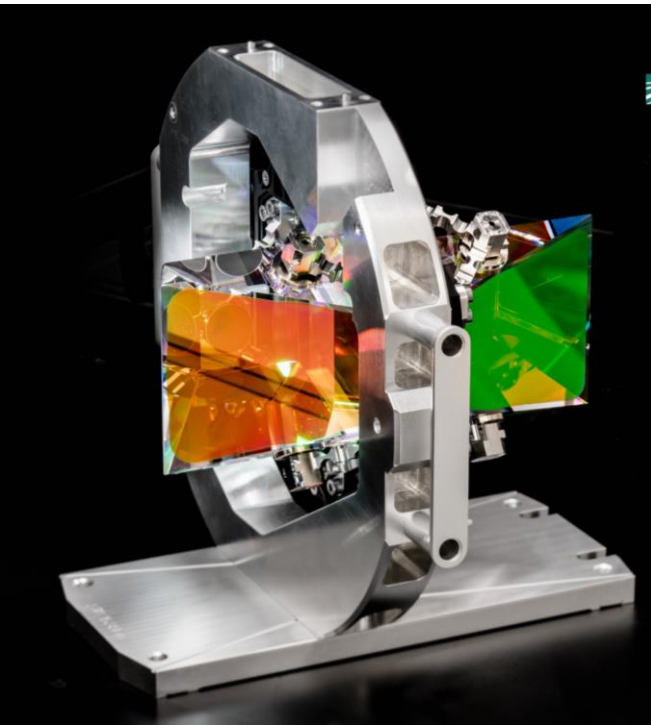
Credits: EMPA



Credits: TASiF

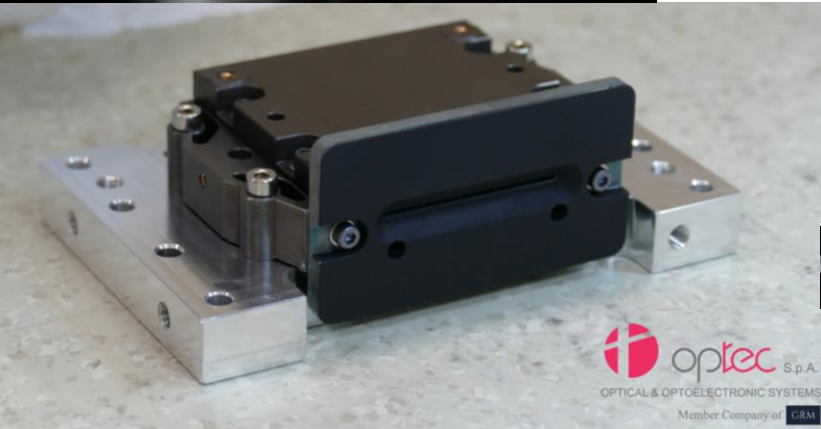


Credit Thales Alenia Space



Credit IOF
Fraunhofer

Prism +
Grating +
Prism



Entrance
slit with
110 fibers



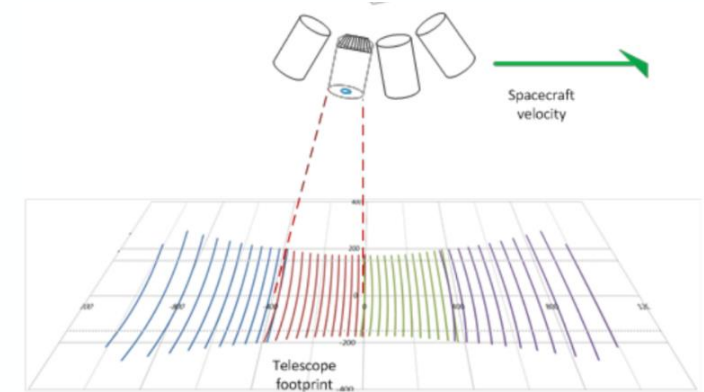
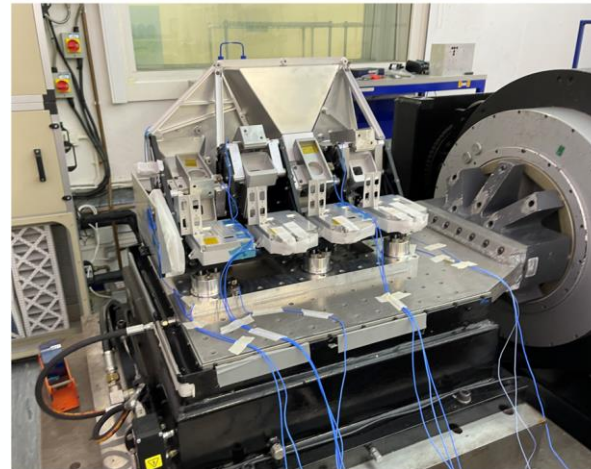
Credit
Optec



Credit Thales Alenia Space

Multi-angle polarimeter (MAP):

- 40 viewing angles (+/- 60°), plus 8 more @larger angles
- Spatial resolution: 4x4 km² while sampling < 1x1 km²

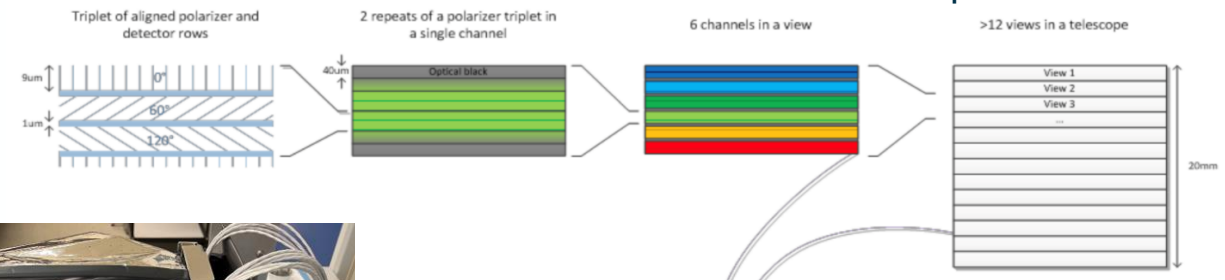


Credit Thales Alenia Space

Cloud Imager

Binning on-ground, specs @400m

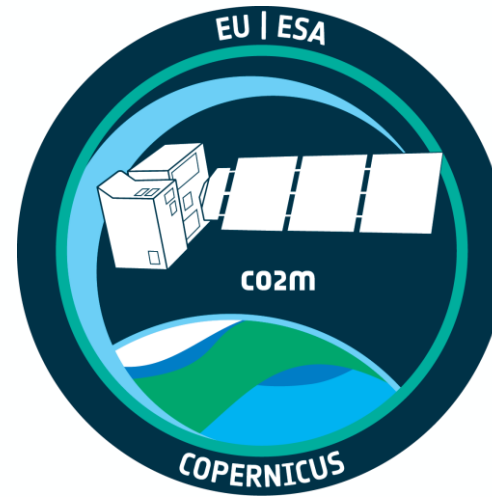
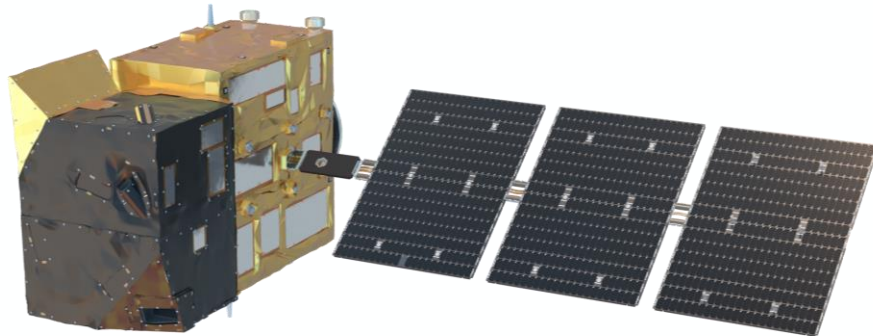
Band	Band center	Band width	Native sampling (ALTxACT)
CLIM-1	670 nm	20 nm	94m x 87m
CLIM-2	753 nm	9 nm	94m x 87m
CLIM-3	1378 nm	15 nm	376m x 163m



Credit OIP Belgium

Project status:

- First satellite Acceptance Review **08-2027**
- Second satellite Acceptance Review **02-2028**
- Third satellite is scheduled in **2029**





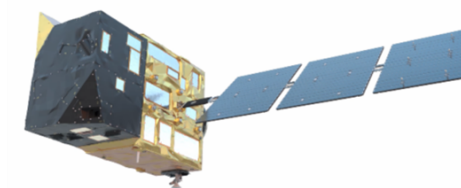
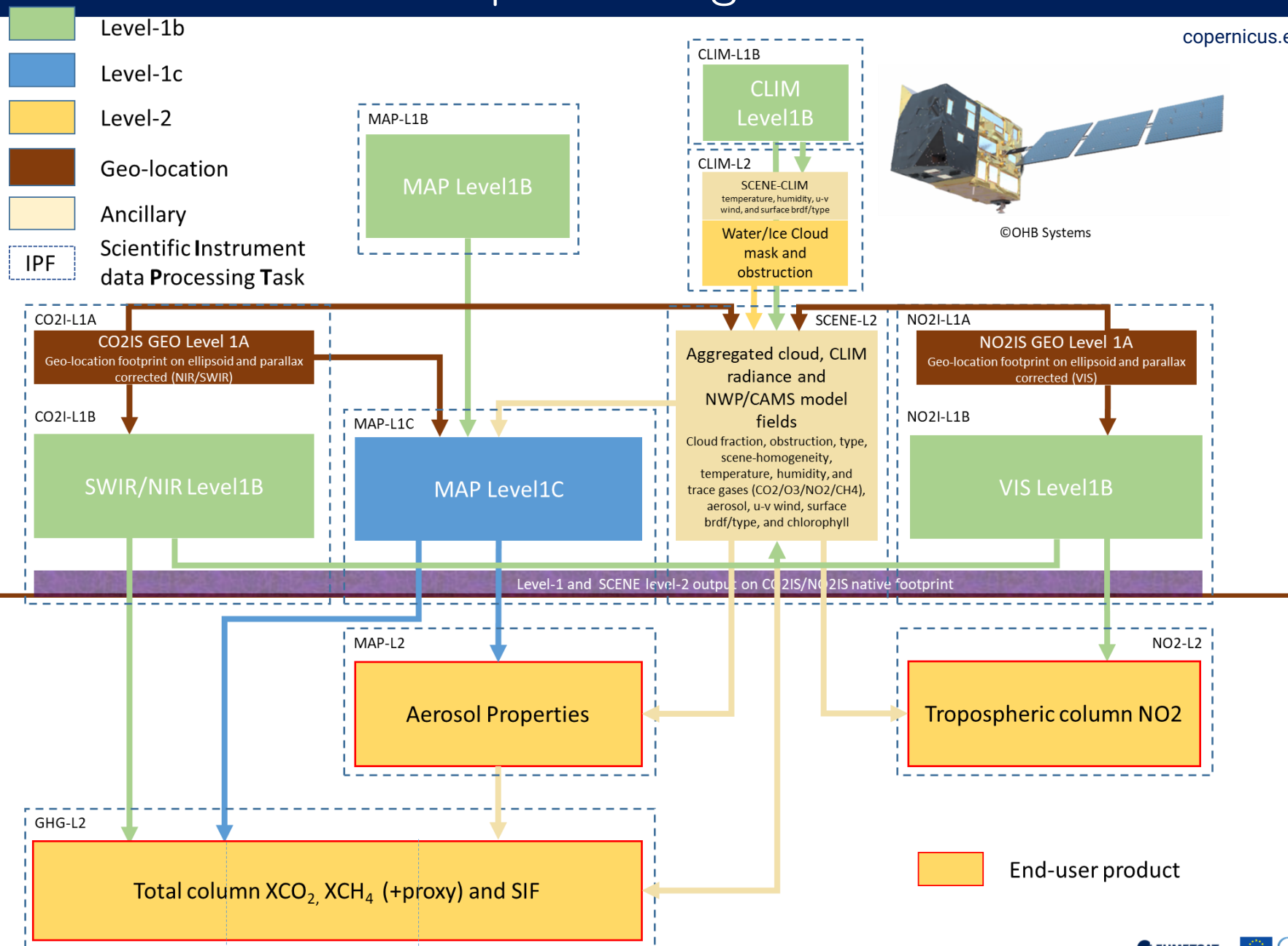
EUMETSAT CO2M MDPS scientific processing tasks

copernicus.eumetsat.int

CO2M Mission Data Processing System

Make one
“hyper-GHG/NO2-
instrument”
out of three!

Below this level: everything is
co-registered or provided at the
CO2I/NO2I spectrometer
footprint



©OHB Systems



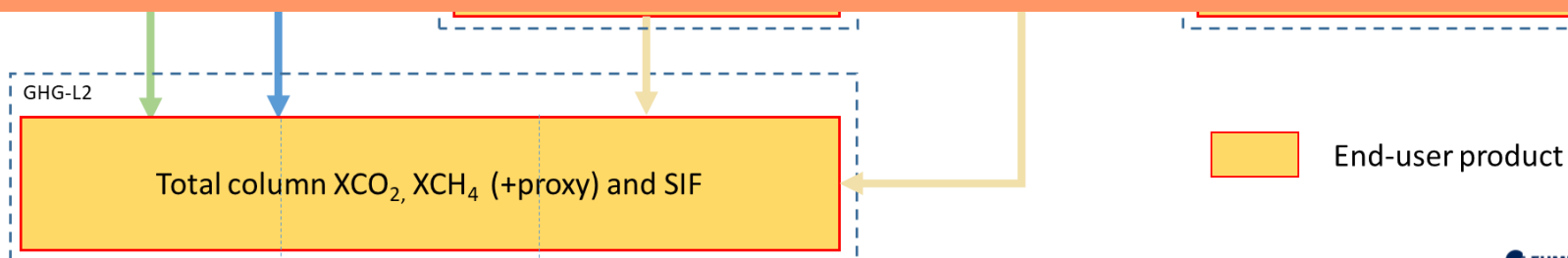
CO2M
Mission
Process

Make on
"hyper-G
instrume
out of th

Below this l
co-registered
CO2I/NO2I s
footprint

Status of CO2M operational processor developments:

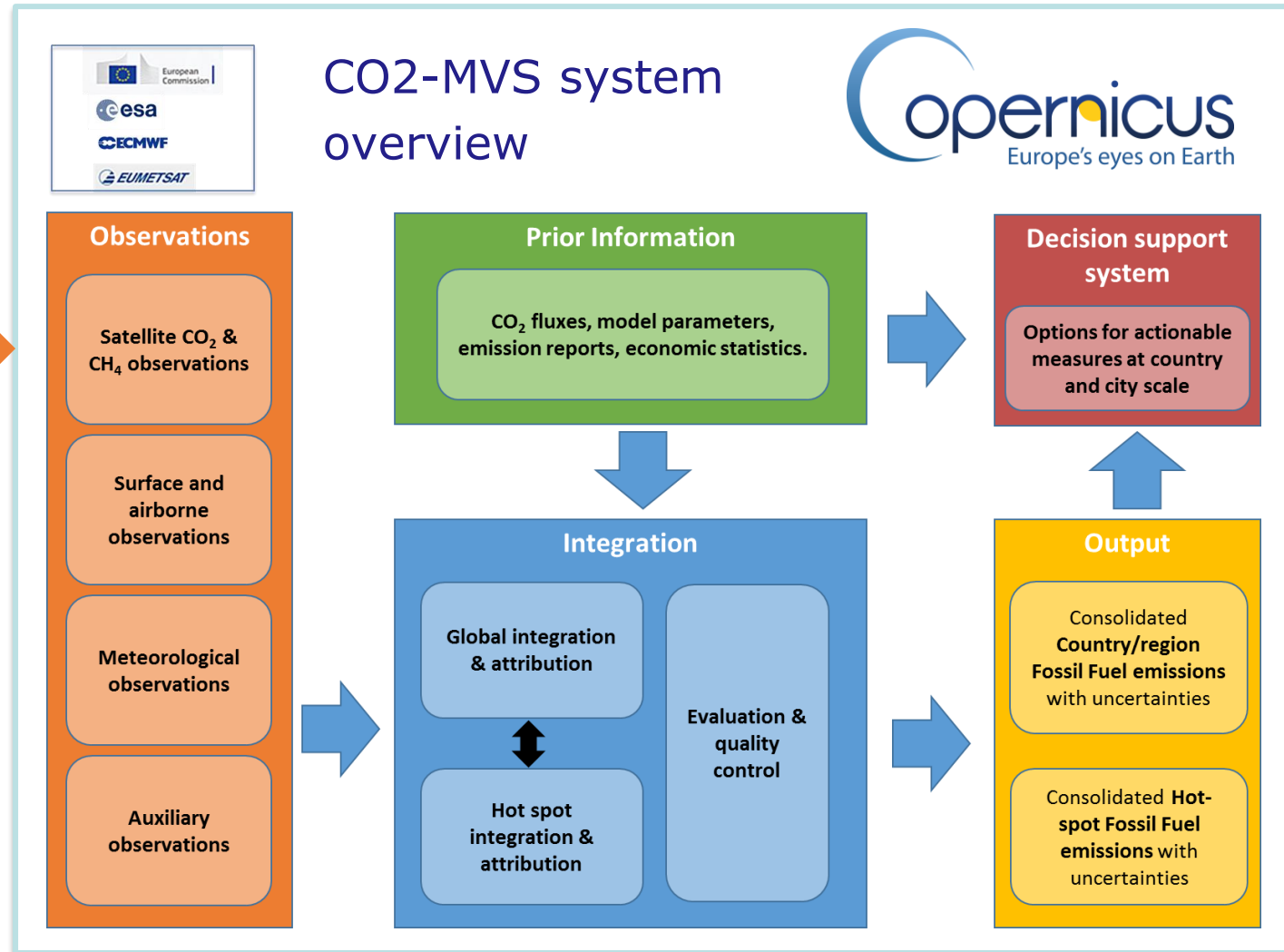
- CDR successfully passed in Q1 2025
- First fully functional processor versions handed over for implementation in EUMETSAT CO2M processing sub-segment
- Scientific developments and improvements ongoing
- Next major versions expected after ground-calibration campaigns in 2026



Anthropogenic CO₂/CH₄ Monitoring and Verification Support (MVS) Capacity



CO2M





CO₂/NO₂ observation statistics

Estimated amount of data (per dayside orbit, per satellite):

Number of measurements (CO ₂ /NO ₂):	~1.1 million
Number of clear sky GHG retrievals:	~200.000
Level-1 / Level-2 GHG product sizes:	~35 / 5 GB
All CO ₂ M products:	~320 GB

Estimated number of possible XCO₂/XCH₄ L2 retrievals:

Worst case (max land) Scenario

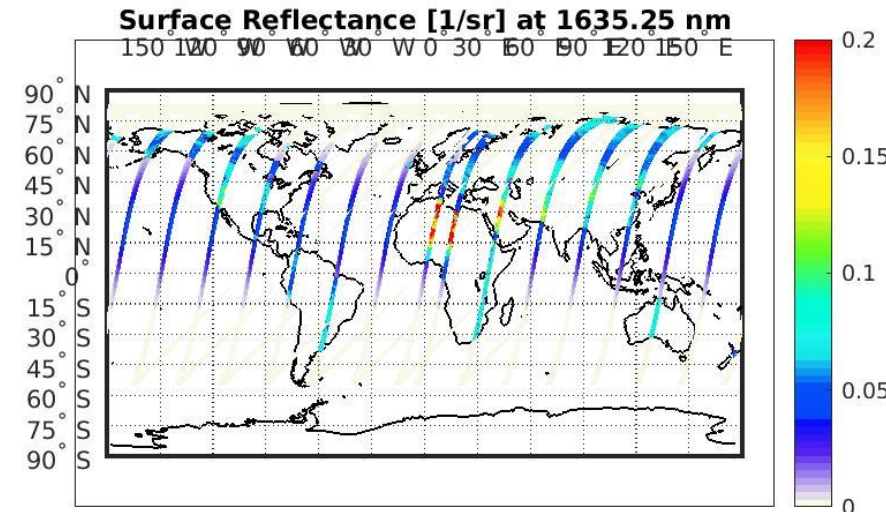
Orbit type	Worst case (max land) Scenario	Number of observations with surface albedo > 0.03	20 % of total (land/water) used for GHG retrieval due to cloud (<1%) and AOD<0.5
Nadir	Land	630105	131215
	Water (glint>0.03 albedo)	25971	
Pitched	Land	722035	201586
	Water (glint>0.03 albedo)	285895	

Average (full day) Scenario

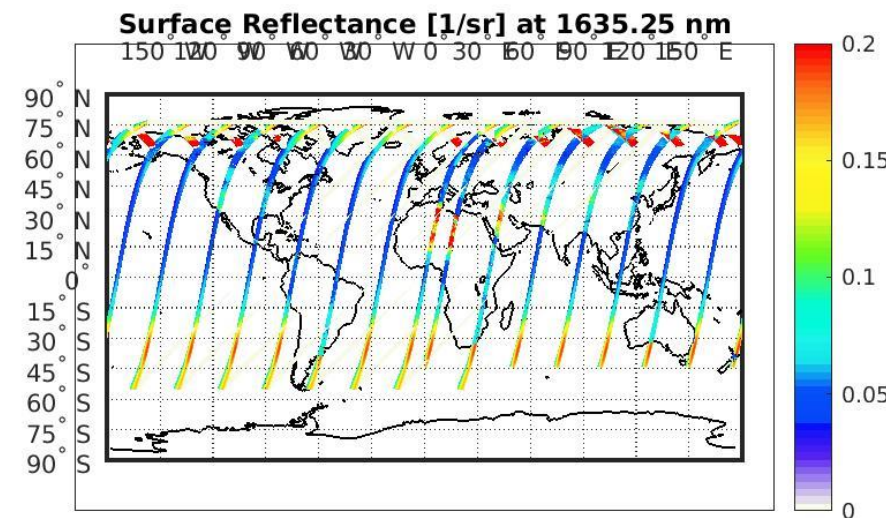
Orbit type	Average (full day) Scenario *)	Number of observations with surface albedo > 0.03	20 % of total (land/water) used for GHG retrieval due to cloud (<1%) and AOD<0.5
Nadir	Land	250530	98065
	Water (glint>0.03 albedo)	249827	
Pitched	Land	239793	200222
	Water (glint>0.03 albedo)	720592	

These figures are per Satellite per orbit.

“Nadir orbit” configuration



“Pitched orbit” configuration





CO2M CO2I spectrometer false colour radiance image (VIS/NIR/SWIR)

CO2M 6-orbits test-data set of top-of-atmosphere radiances for a constellation of 3 platforms

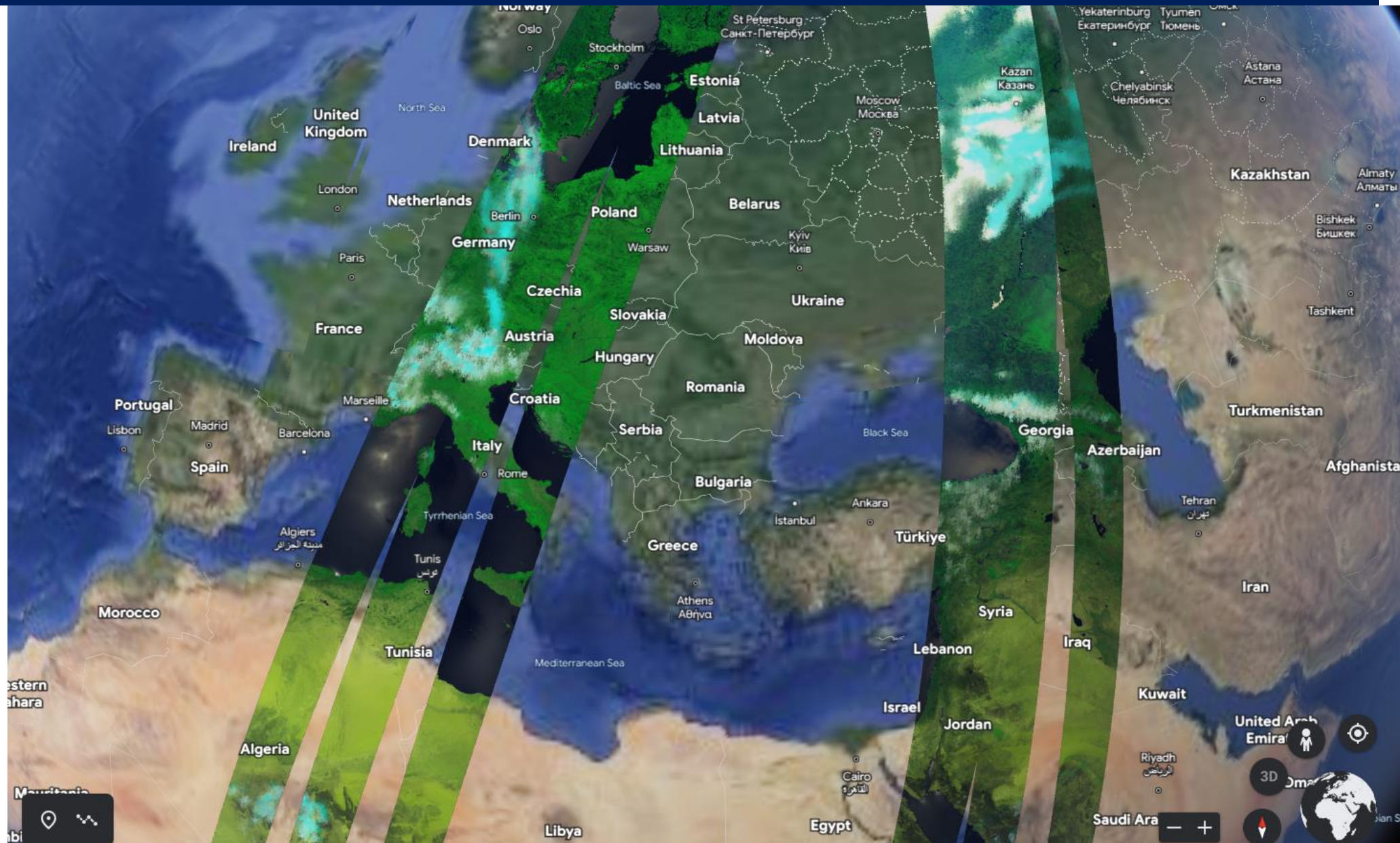
“West” platform continuously pointing towards the sun-glint spot

3rd July 2025

1. EU west (pitch: on)
2. EU cent (pitch: off)
3. EU east (pitch: off)

23rd Sep 2025

1. Asia cent (pitch: off)
2. Asia west (pitch: on)
3. Asia east (pitch: off)



Complementarity, resilience and performance:

- ✓ Different physical retrieval approaches - Full-physics (RemoTAP/FUSIONAL-P), scattering approximation (FOCAL);
- ✓ Different heritage lines (SCIAMACHY, OCO-2, GOSAT, Sentinel5p/5, 3MI, SPEXOne, POLDER);
- ✓ Complementary exploitation of information content of CO2M payload information (CO2I/MAP/CLIM);
- ✓ Complementary processing cost (cheap, medium, heavy).

CO2M platform information content usage:

Processing step	GHG L2 Input		
	RemoTAP	UoL-FP-FUSIONAL-P	FOCAL
Pre	SCENE-L2	SCENE-L2	SCENE-L2
Main	CO2I L1B+MAP-L1C	CO2I L1B+MAP-L2	CO2I L1B
Post			MAP-L1C/L2+CLIM L2

Prelim. processing cost estimates:

GHG L2 :
(3 algorithms)
< 3700 cpus / platform*)

Full system processing:
(including all instruments level-1 and 2)
< 4200 cpus / platform*)

*) Multiple platforms will require less per platform on average because of cpu re-usage



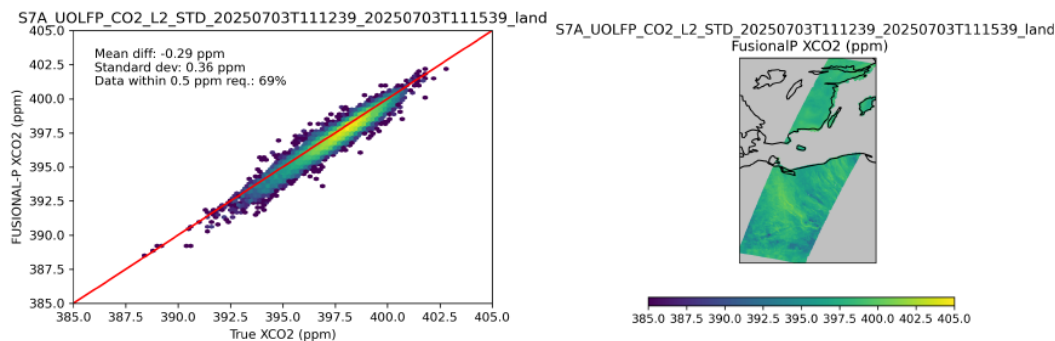
Early results from synthetic data (GHG level-2 XC02)

Three GHG algorithms for CO2M

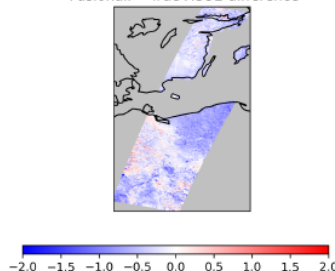
FOCAL



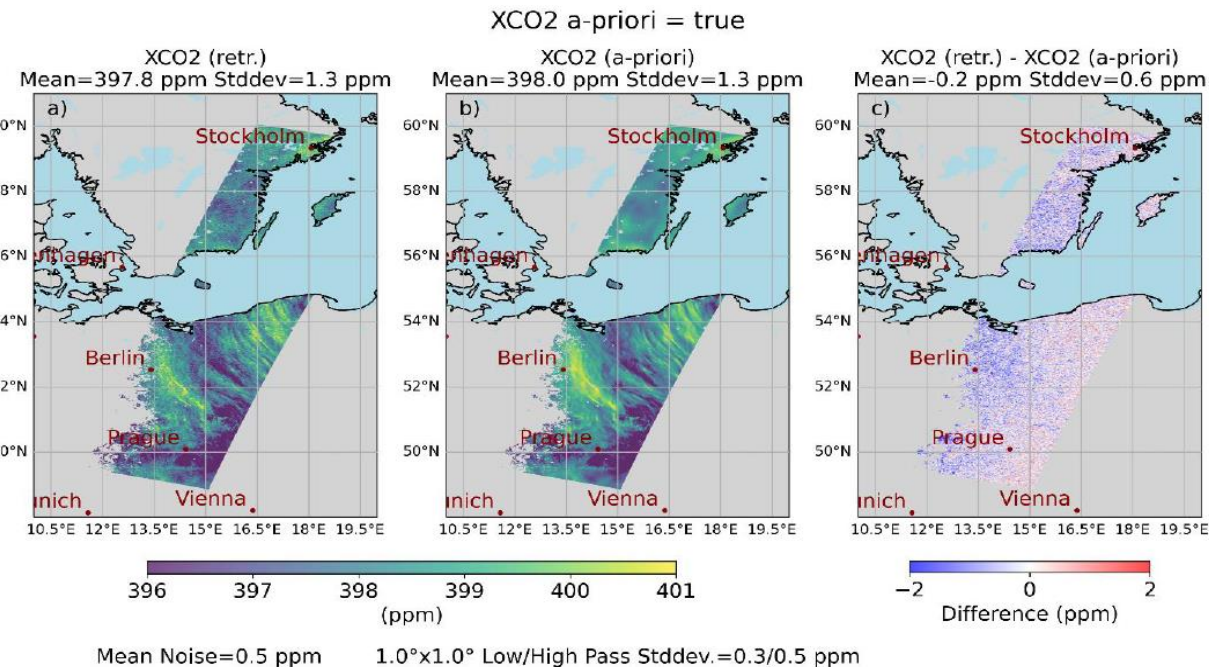
Processing step	GHG L2 Input		
	RemoTAP	UoL-FP-FUSIONAL-P	FOCAL
Pre	SCENE-L2	SCENE-L2	SCENE-L2
Main	CO2I L1B+MAP-L1C	CO2I L1B+MAP-L2	CO2I L1B
Post			MAP-L1C/L2+CLIM L2



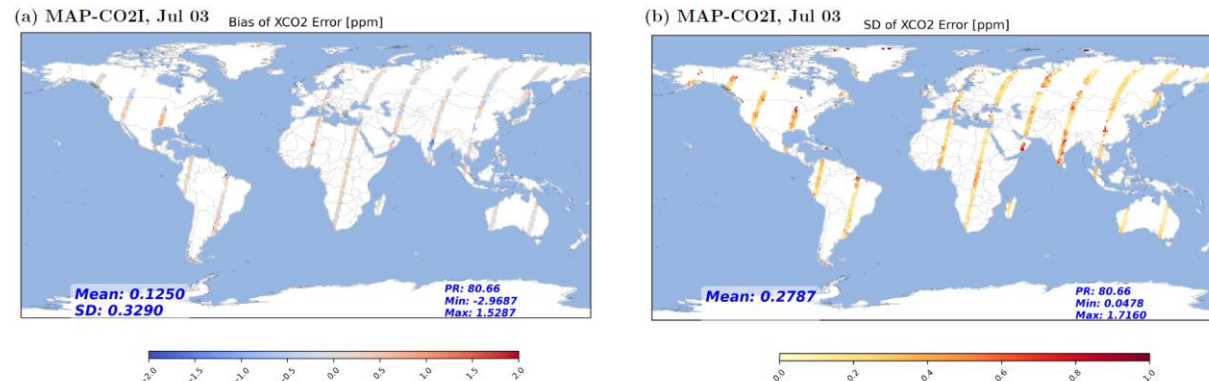
d 57A_UOLFP_CO2_L2_STD_20250703T111239_20250703T111539_land



UoLFP



RemoTAP SRON

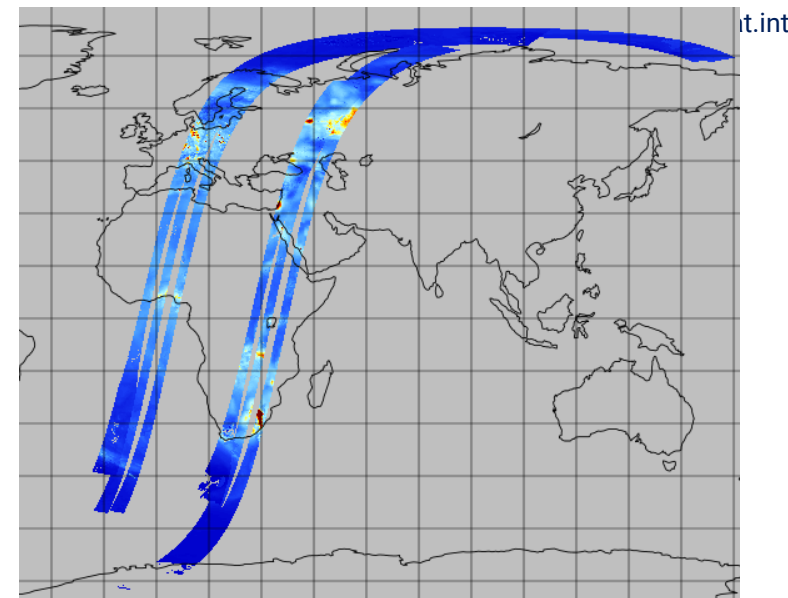
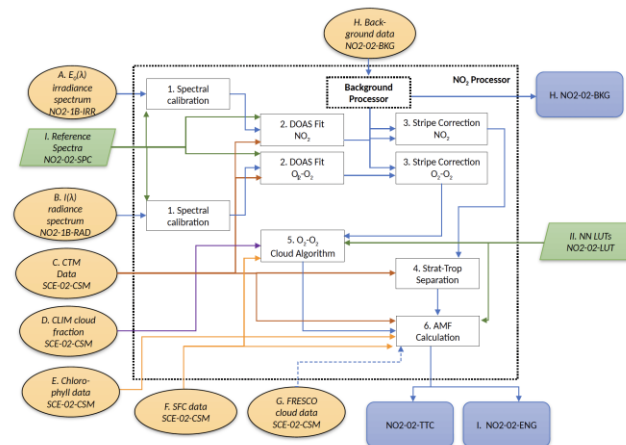




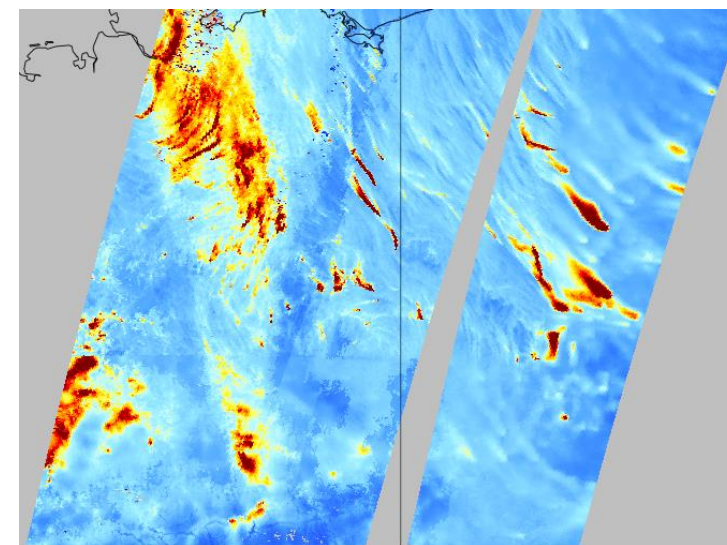
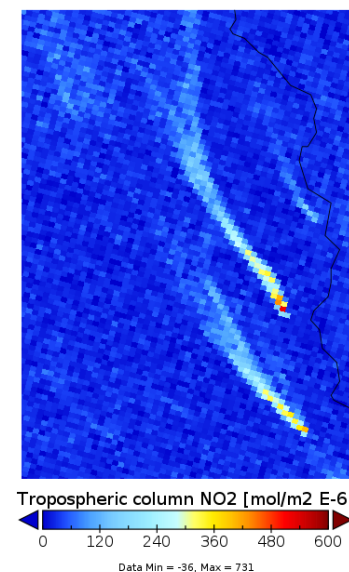
The CO2M NO2 level-2 product

Based on heritage from OMI/TROPOMI NO2 algorithms

- **DOAS fit left unchanged**
 - CO2M: solar irradiance measurements
- **Troposphere-stratosphere separation:**
 - No assimilation CTM system as in TROPOMI
 - Use of CAMS global model data
 - As of CAMS IFS cycle 48R1: full stratospheric chemistry
- **Cloud correction:**
 - O2-O2 DOAS (VIS) with scattering cloud model
 - O2-A (NIR) as fallback
 - CLIM cloud information
- **Air-mass factors (AMF):**
 - Hi-res surface BRDF/DLER information
 - Scattering cloud model
 - CAMS NO2 a-priori profile shape (~40 x 40 km²)



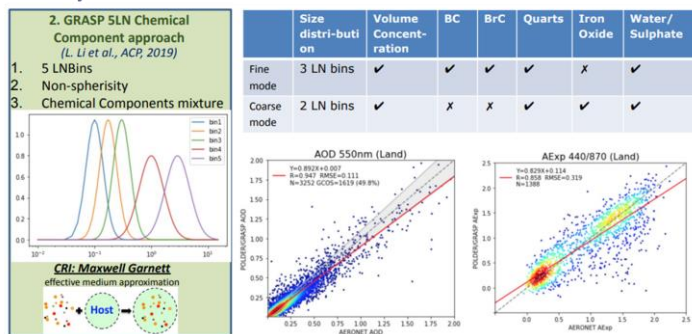
L2 using RAL SCENE



C02M MAP level-2 aerosol product

copernicus.eumetsat.int

The GRASP/Components aerosol model has been selected for MAP with 3x3 MAP L1C pixels fitted simultaneously.



The GRASP (Generalized Retrieval of Aerosol and Surface Properties) is used for the simultaneous retrieval of both aerosol and surface properties.

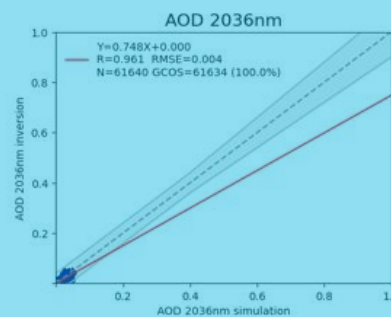
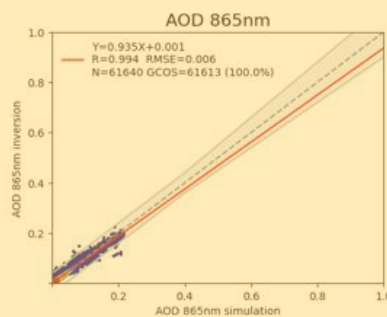
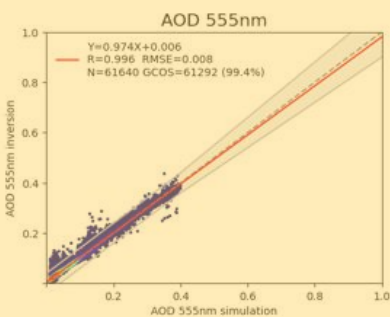
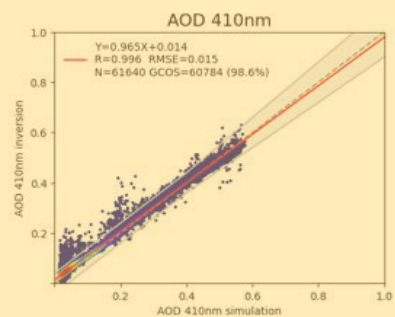
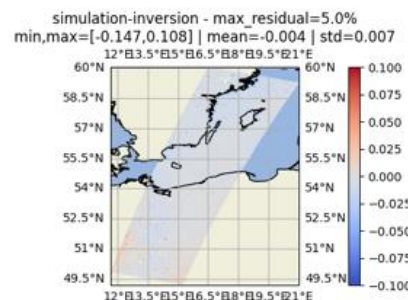
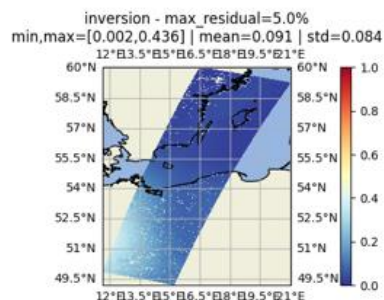
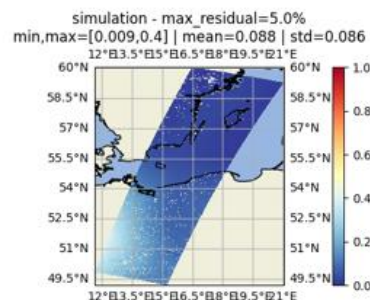
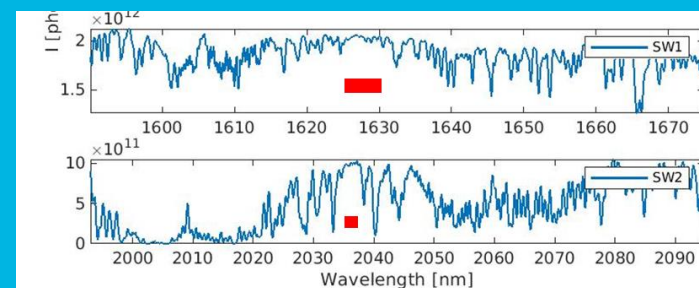
Aerosol retrieval performed in the VNIR, is used for an atmospheric correction in the SWIR for the CO2 retrieval.

MAP Band	Wavelength
VNIR-1	410 nm
VNIR-2	443 nm
VNIR-3	490 nm
VNIR-4	555 nm
VNIR-5	670 nm
VNIR-6*	753 nm
VNIR-7	865 nm

+

CO2I SWIR1/2 background reflectance

- SWIR 1: 1620-1627.5 nm
- SWIR 2: 2034.9-2037.5 nm





CO2M cloud information from CLIM data for GHG/NO2/AOD

clim_data/	
scene_inhomogeneity	[scanline×ground_pixel × clim_ch *)]
cloud_fraction	[scanline×ground_pixel x cloud_area]
cloud_obstruction	[scanline×ground_pixel]
cloud_top_height	[scanline×ground_pixel]
cirrus_fraction	[scanline×ground_pixel x cirrus_area]
cirrus_obstruction	[scanline×ground_pixel]
cloud_optical_thickness	[scanline×ground_pixel]
cloud_optical_thickness_uncertainty	[scanline×ground_pixel]
cirrus_distance	[scanline×ground_pixel x cloud_area]
cloud_distance	[scanline×ground_pixel x cirrus_area]

Cloud_shadow_mask [scanline×ground_pixel]

*) clim_ch=CLIM1/2

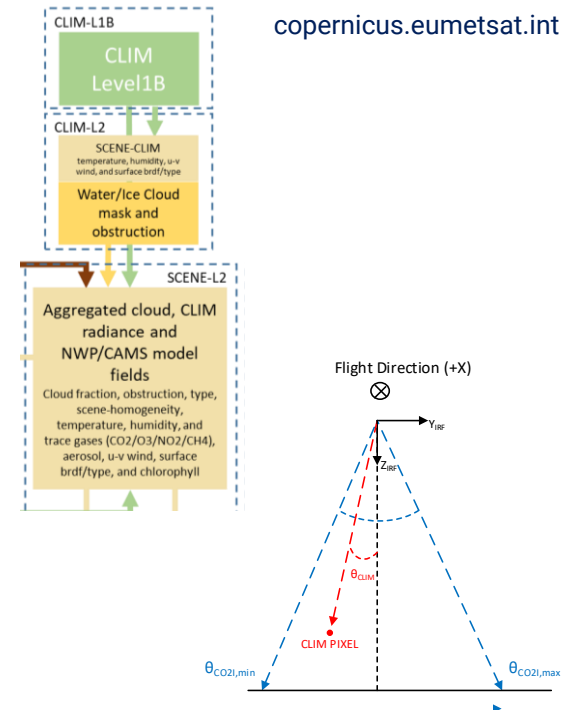
cloud_area / cirrus-area

4 areas covered

Area around CO2I/NO2I centre pixel lat/lon:

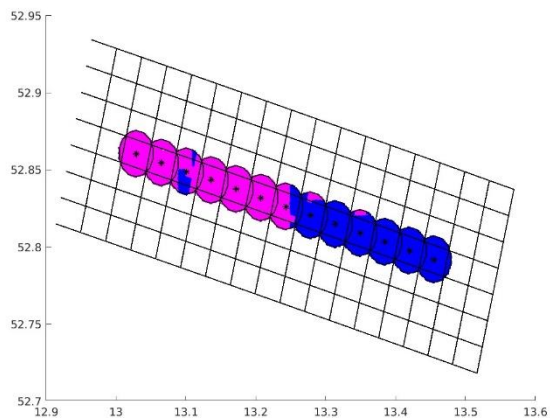
semimajor = [0.02 0.04 0.06 0.08]

semiminor = [0.02 0.04 0.06 0.08]

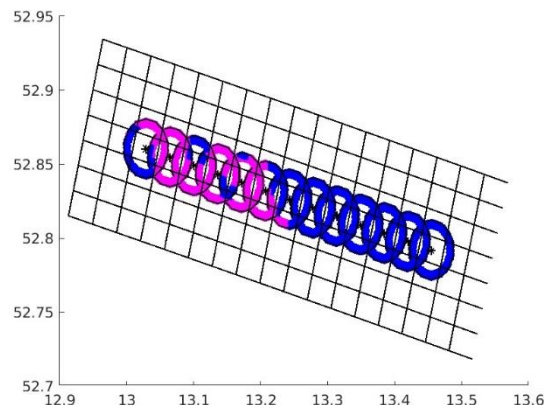


Sub-set of CO2I swath:

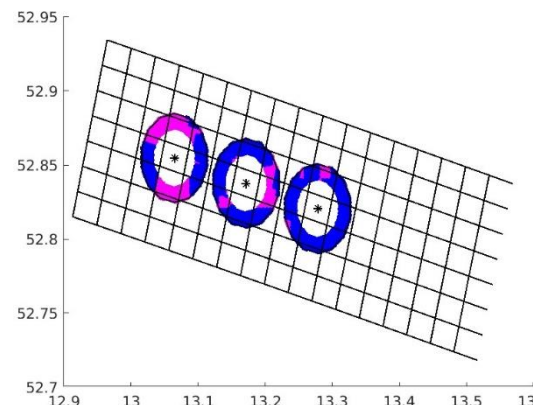
Aggregation area / CLIM cloud mask:



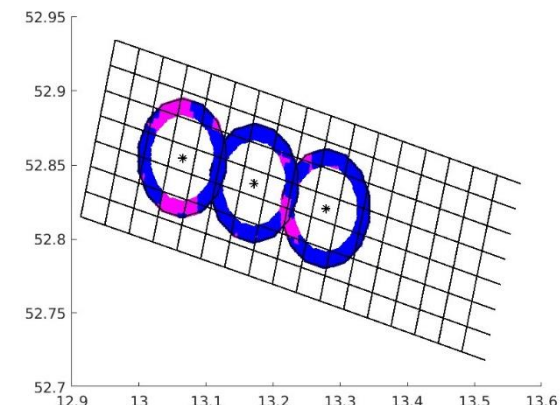
circle 1



circle 2



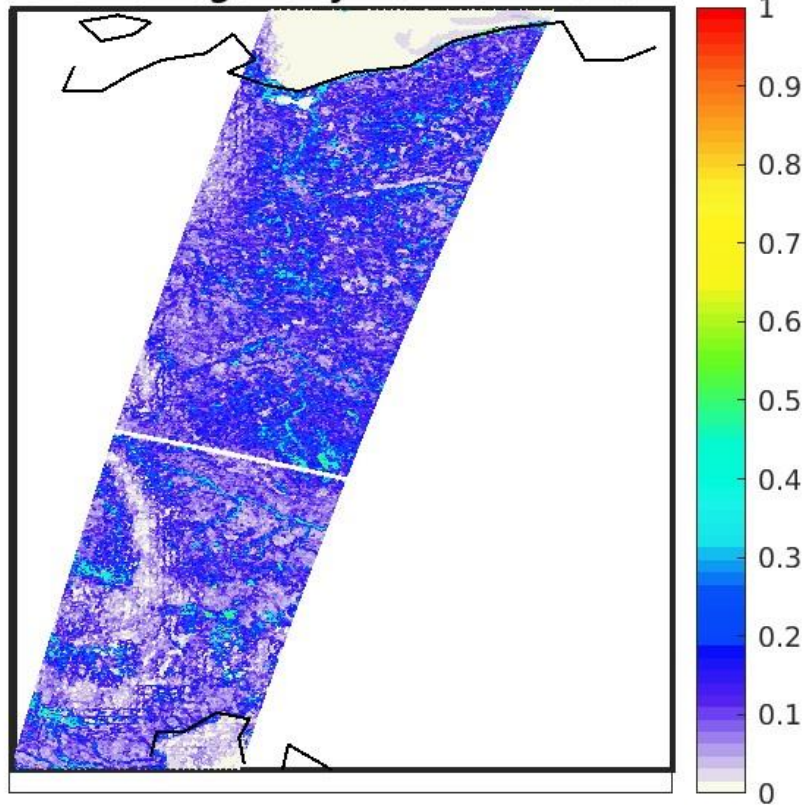
circle 3
(only every 3rd plotted)



circle 4
(only every 3rd plotted)

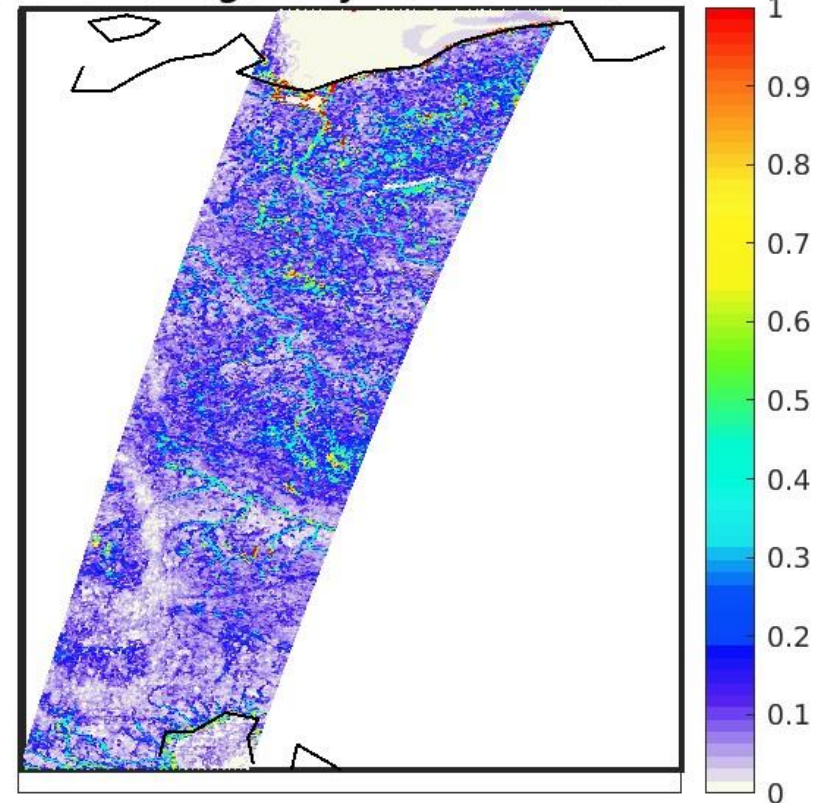
Scene-inhomogeneity: $\text{std}(I_{\text{vis/nir}})/\text{mean}(I_{\text{vis/nir}})$

Scene-homogeneity from CLIM 670 nm



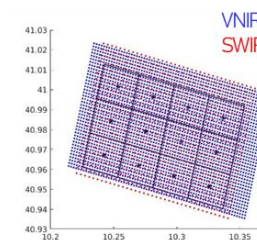
At 670 nm

Scene-homogeneity from CLIM 752 nm

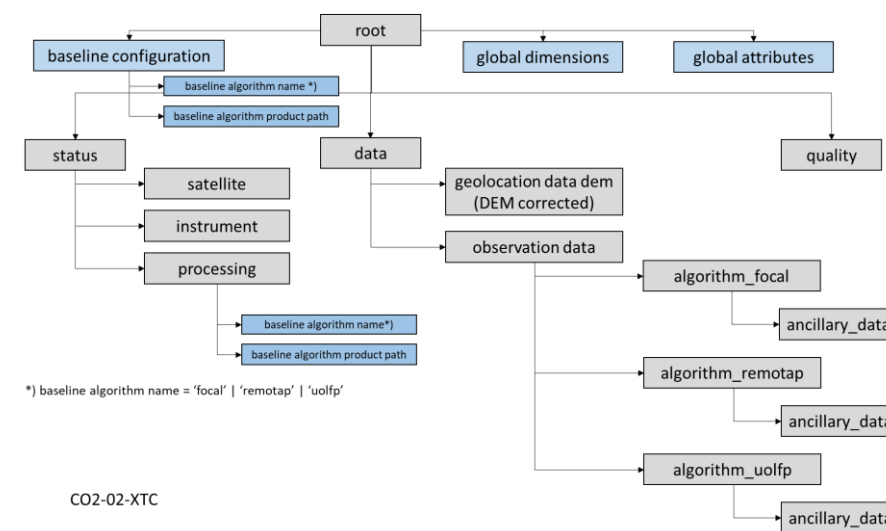


At 752 nm

~200 CLIM measurements aggregated to C02I/N02I footprint:



- CO2M products Level-1 to Level 2 will be made available from the EUMETSAT Data Store **without restrictions!**
- Products will be available in **netcdf4 format** through Data Store after/during commissioning once products are in pre/operational status.
 - ✓ All products are **self-describing** with meaningful parameter naming and clear and meaningful long-name description, plus all additional attributes according to the CF standard.
- **Tailoring** of the GHG level-2 product will be possible through the data-portal on the following perimeters:
 - ✓ Region and period of interest
 - ✓ Parameters
- Various **means of access** are provided by the data-store:
 - ✓ Web based data-portal (reduced flexibility)
 - ✓ API driven tailoring (python, Jupyter notebook) – large flexibility



CO2-02-XTC

GHG level-2 product structure



EUMETView



EUMETSAT Data store



Data Tailor



EUMETCast Terrestrial



European Weather Cloud

The **EUMETSAT Data Store** provides users with a download and linked data tailoring service for online data; providing access through an online web user interface and via a suite of APIs.



Service available at: <https://data.eumetsat.int>



“Four+-pillar” CO2M validation

copernicus.eumetsat.int



CO2M Calibration and Validation Plan

CO2M product
Cal/Val plan

CO2M product
Cal/Val plan

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GSICS

On-board Cal:

Source	CO2I	MAP	CLIM	Frequency
SUN	X	X		daily
Moon	X	X	X	Irreg.
WLS	X			weekly
Tuneable LED	X (ISRF)			
Dark	X	X	X	orbit

Vicarious Cal
“as needed”



CO2M
0.3 nm (@1.6 μ m)

- SNOs
- Ref. Targets
- etc.

Cross-Cal



MicroCarb, OCO-x, GOSAT-x, S5, etc.

~0.05 nm (@1.6 μ m)

GSICS

Product VAL

Product Cal/Val

Product Cal/Val

Product Cal/Val

Cross-Cal

Cross-Cal

Spectrally oversampled
reference

Similar spectral resolution



PaNIR
2.5 nm (@1.6 μ m)



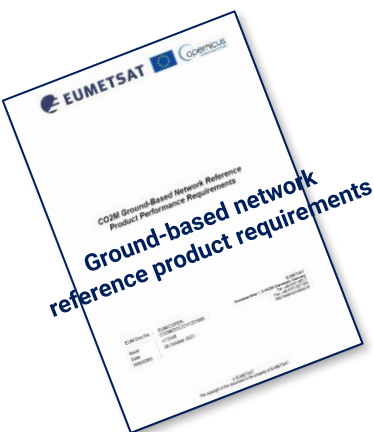
COCOON
0.14 nm (@1.6 μ m)



TCCON
0.005 nm (@1.6 μ m)

“Four-pillar” CO2M operational product validation and monitoring space-to-ground and space-to-space approach

+ NDACC- FTIR CH4 + Pandonia/NDACC-NO2 + Aeronet for AOD

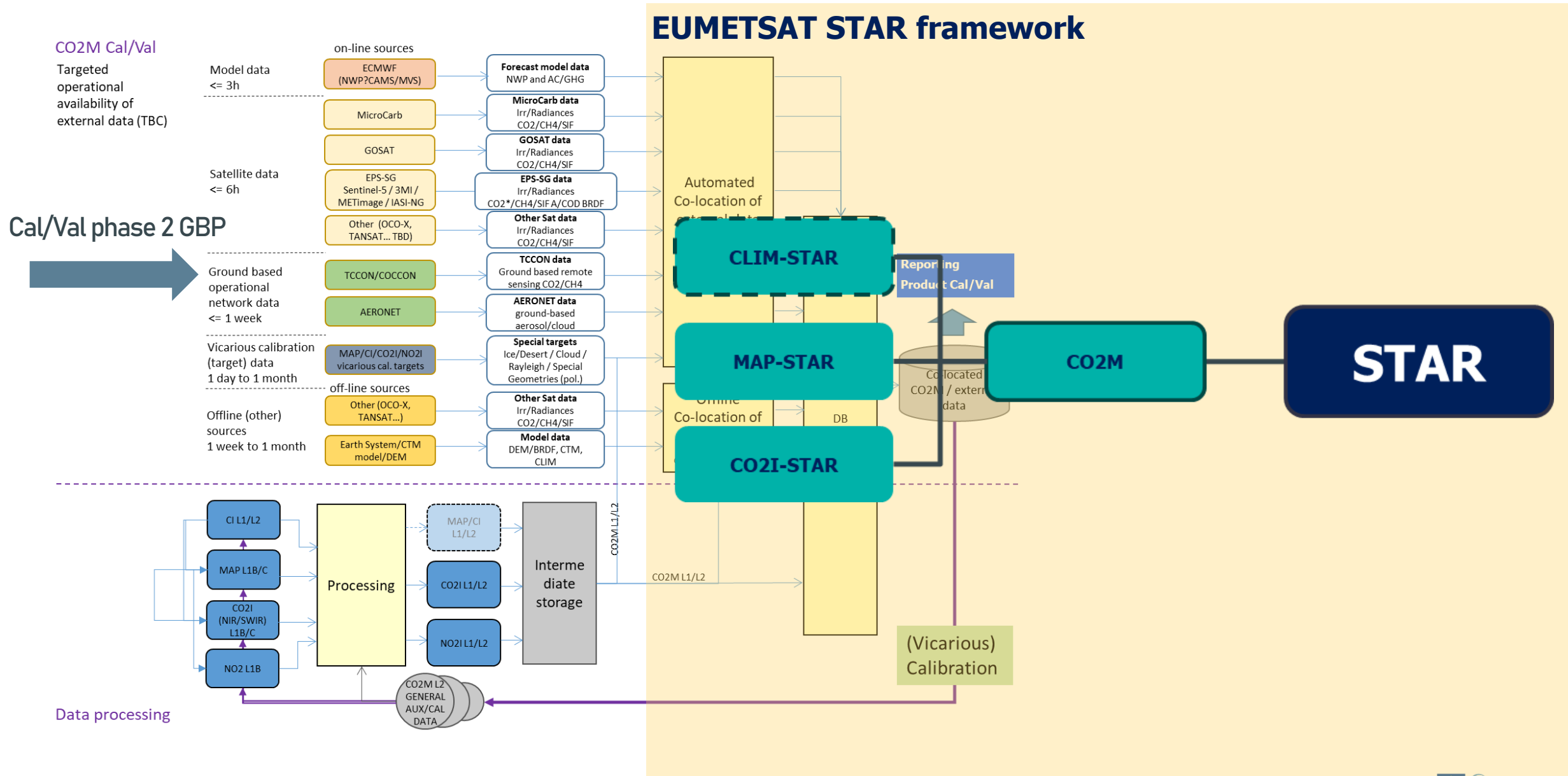


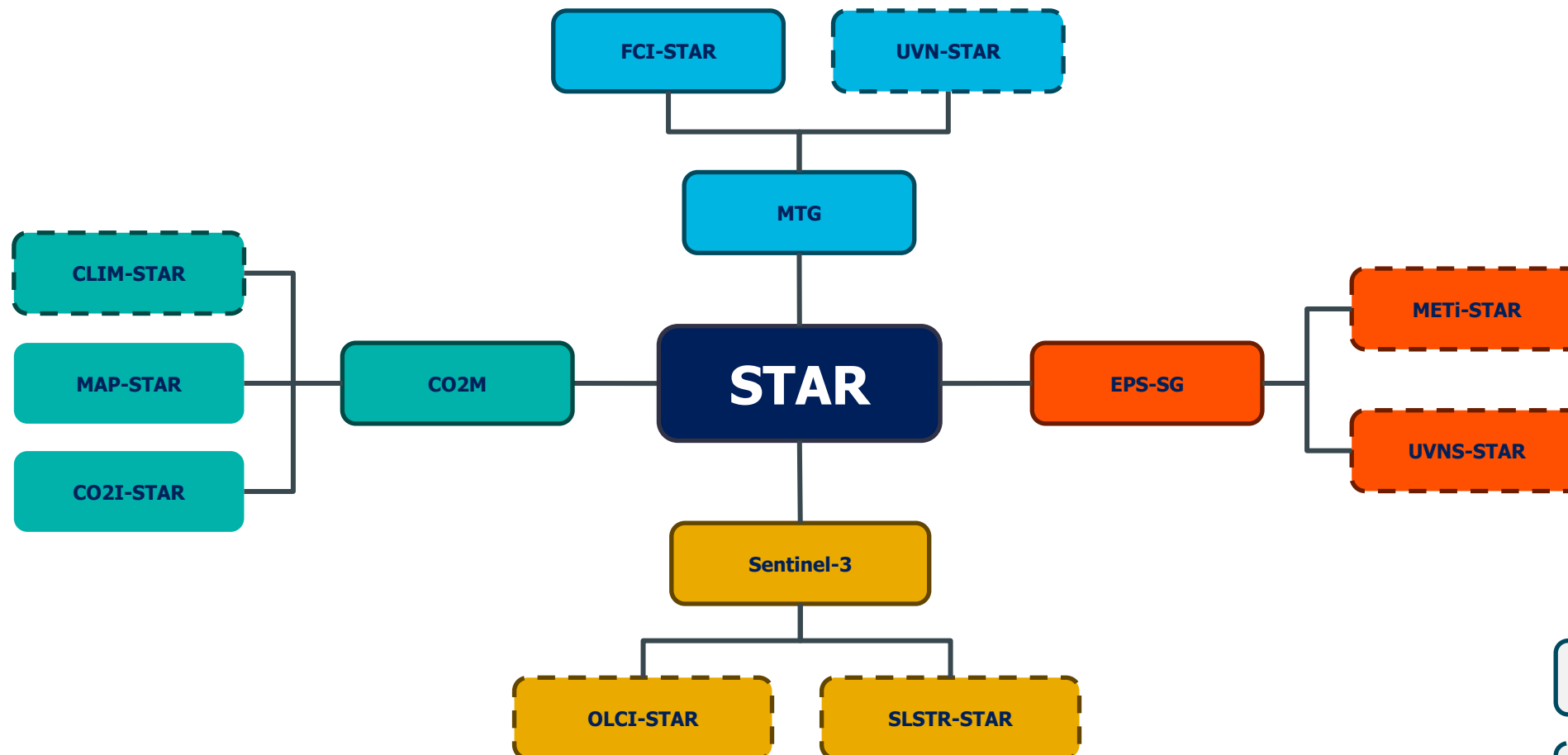
The accumulation of significant and representative statistics during the course of product commissioning (and to be continued thereafter) is of highest priority:

- To discriminate the different bias contributors
- To make bias emerge from noise

Means

- Priority on continuous collection of reference data with high automation, low human resource need and low carbon cost
- Significant contribution of in-flight accumulated reference data (vicarious statistical and/or from stable well-known targets)
- Re-use of existing operational validation and monitoring environments (see next slides)
- Methodologies and capabilities are developed as part of individual product science support services, including two dedicated Cal/Val studies
- Dedicated validation support teams and adequate will be put in place per product (Cal/Val plan updated section on roles and responsibilities – see below)
- Dedicated campaign data as available





operational

in dev.

planned



EPS-SG S5/MTG S4/CO2M Cal/Val Plan

www.eumetsat.int

Joint plan for activities of calibration and validation for Sentinel-4, Sentinel-5, and CO2M during commissioning

- Ad-hoc activities

- Formal testing
- CKD Validation and Update

- Performance monitoring

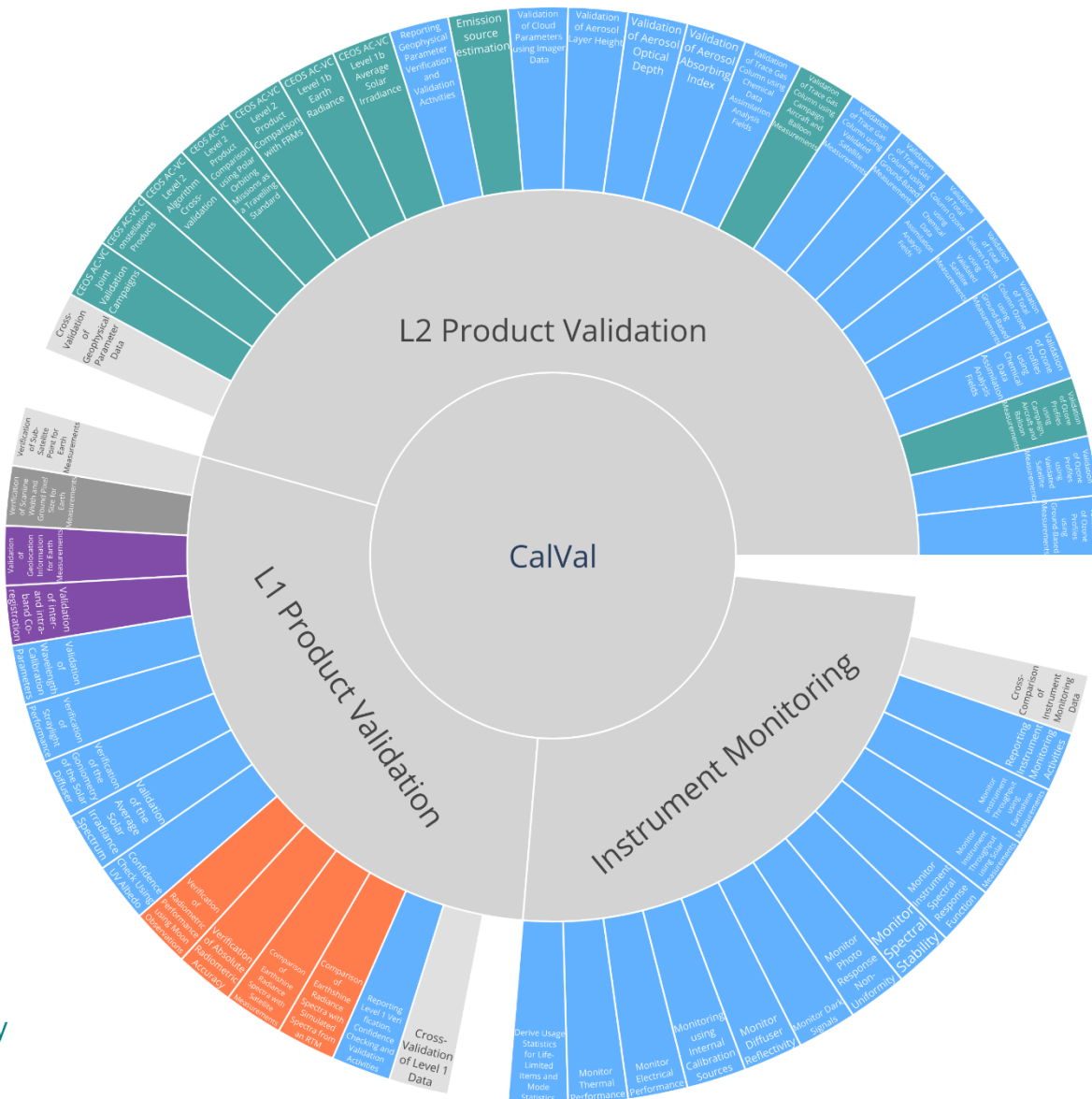
- Routine processing using Offline Environment (e.g. UVNS-STAR, MICMICS, PIQMICS)
- Scheduled reporting of instrument and product quality

- Community activities

- AOCall for external L2 products validation
- Service Contracts for L1 and L2 activities

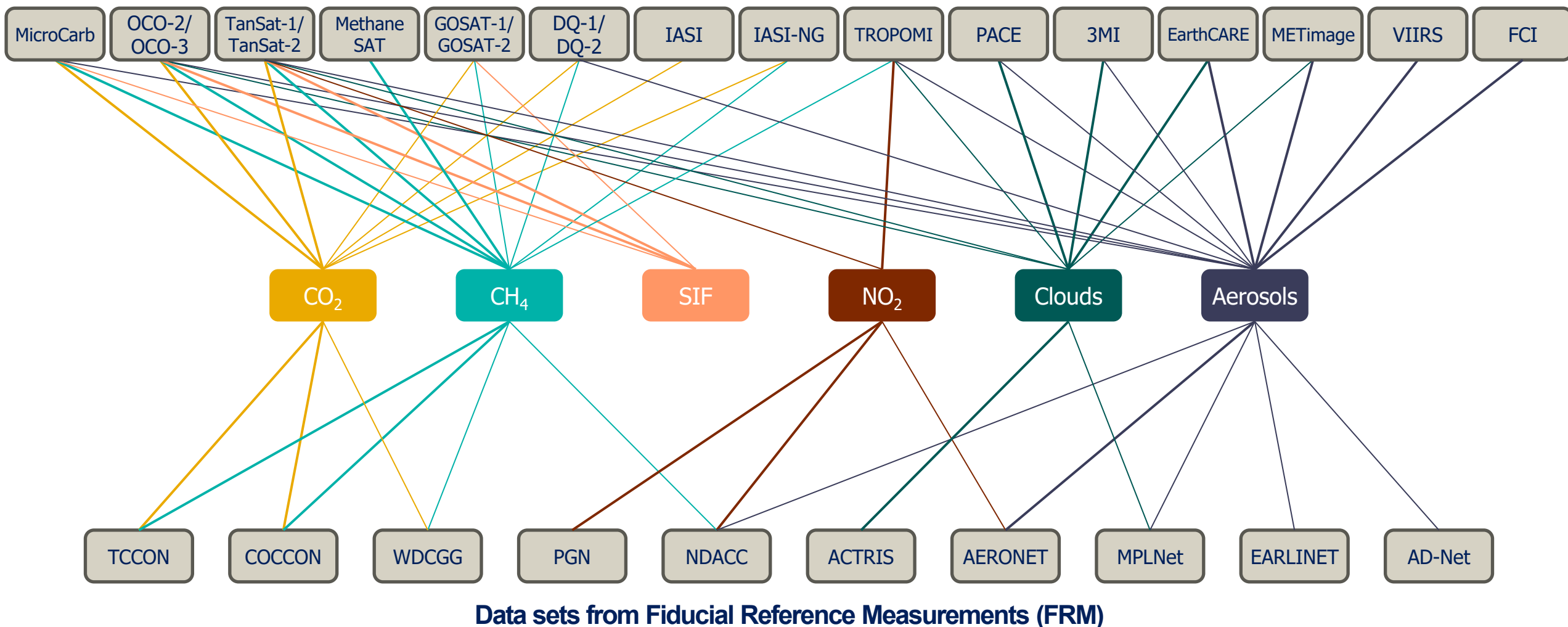
- Offline Tool Functional Testing:

- Dry run wrap-up: 05th Sept 2024
- Delta dry run wrap-up: 03rd June 2025



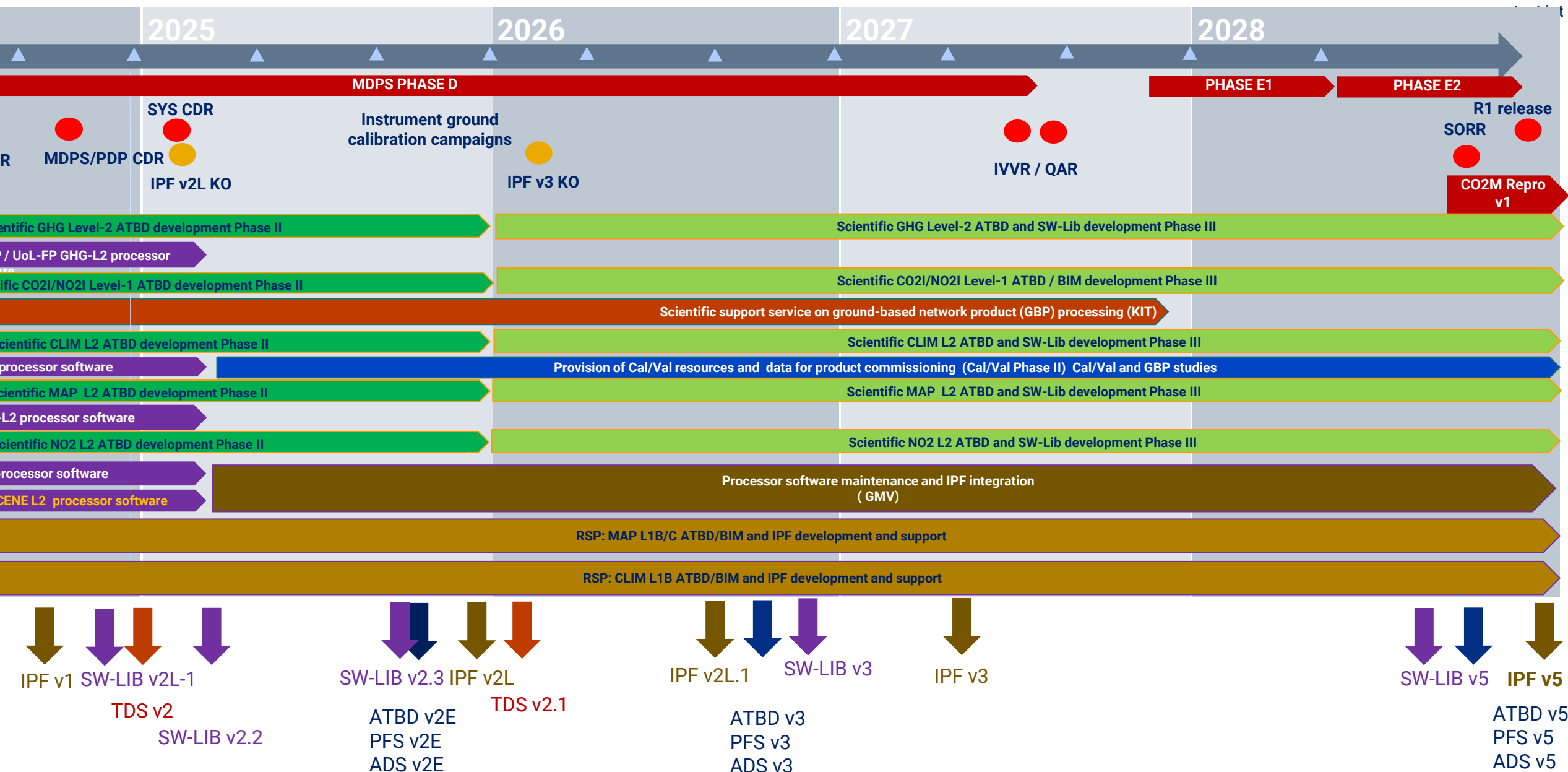


Data sets from satellite instruments



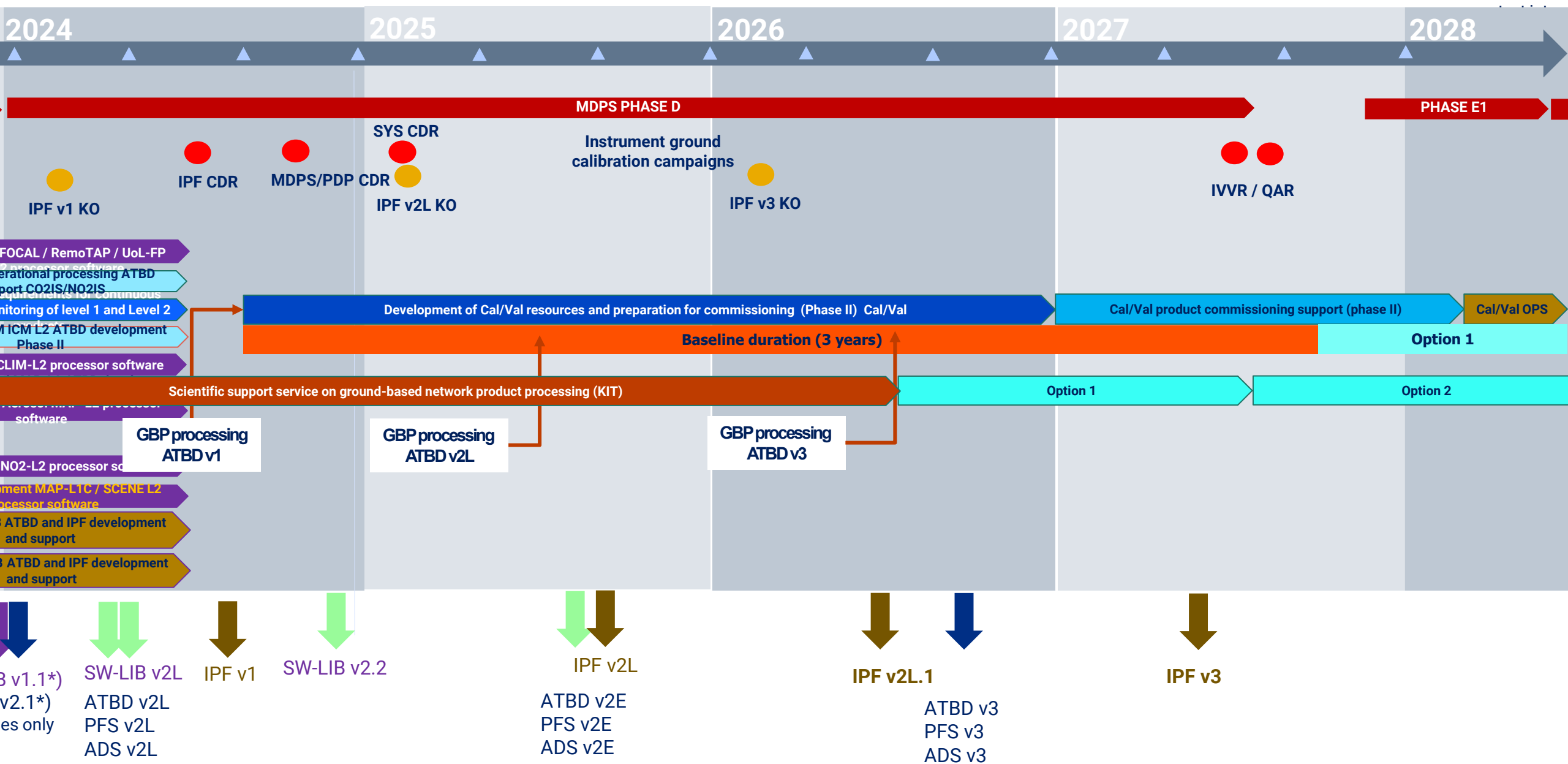


EUMETSAT Mission Data Processing System science and development activities

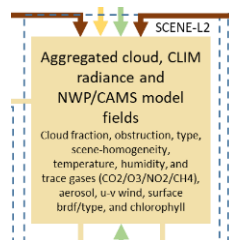




EUMETSAT Mission Data Processing System science and development activities

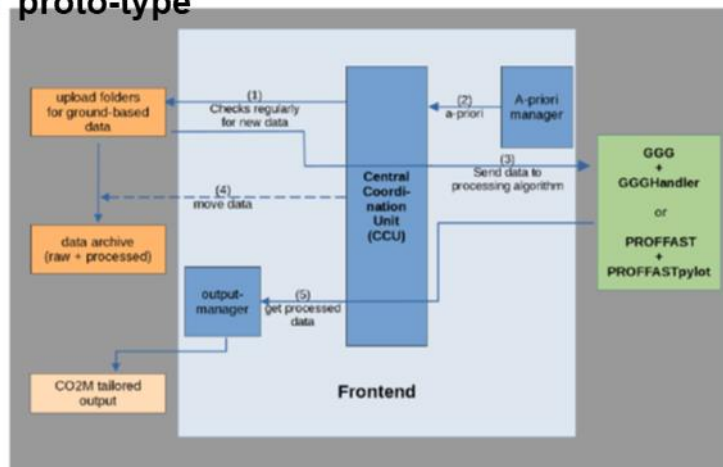


- ✓ **Phase 1 of CO2M product validation study (GBP requirements, network-status, and validation methods) ended in June 2024.**
- Definition of Ground-Based Product (GBP) ongoing (KIT GBP service). V2L of ATBD and Input/Output definition expected for Summer 2025.
- **Phase 2 of CO2M product validation study – Commissioning preparation, evolution of validation methods, interface for provision of network/validation data, provision and processing of data – kick-off 3rd June 2025.**

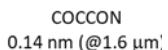


CO2M a-priori and auxiliary data products

The EUMETSAT Ground-based Data Processing Facility GDPF proto-type

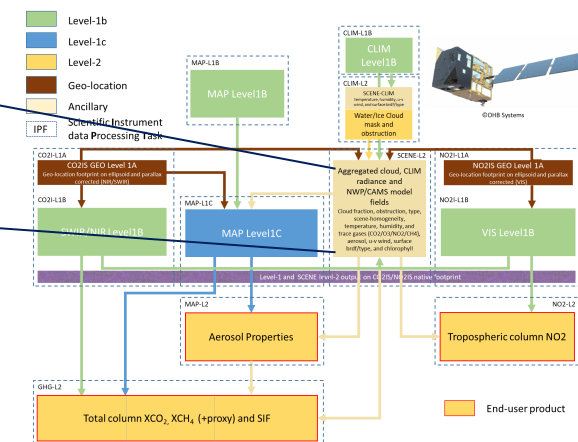


Level-1



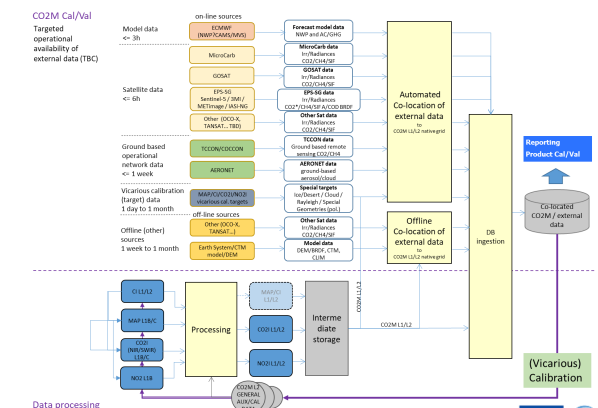
TCCON/COCCON Level-2 fiducial reference data (aim: timeliness < 2 month)

EUMETSAT Mission Data Processing Sub-segment



CO2M products

EUMETSAT Cal/Val Facility





- Finalise the ground-based product requirements document including performance, latency and availability
- Update and maintain the ground-based station/network and overpass statistics and station footprint database
- Prepare for the management and contractual framework (managed and carried out by BIRA) to receive ground-based reference data according to the requirements and against a data provision service fee



- Invite Cal/Val phase 2 advisory board (Frank Hase, Thorsten Warneke, Emmanuel Mahieu) to all progress meeting and for dedicated advisory board meetings (yearly TBC))
- Invite all interested data-provider to a CO2M Cal/Val GBP data-provision meeting beginning of 2026.
- Announcement of intention to procure data (“ground-based data provision service”) is planned for Q1 2026.



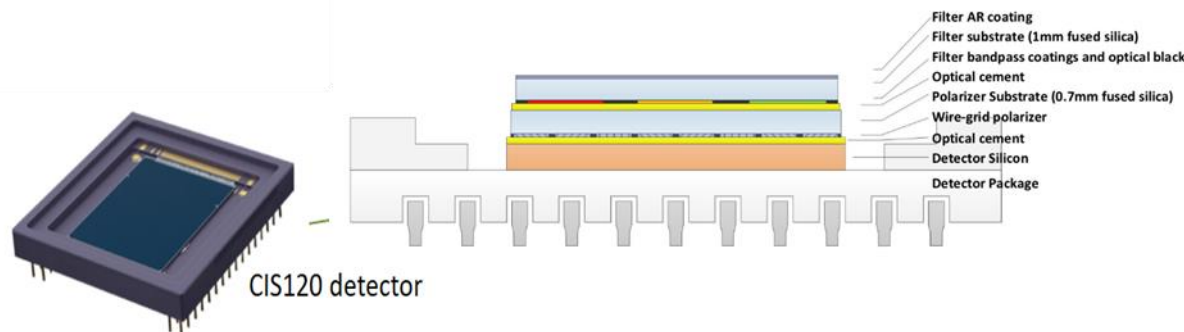
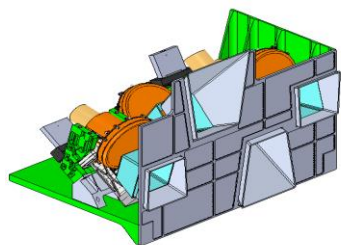
C02M Mission Data Processing Sub-segment developments

copernicus.eumetsat.int

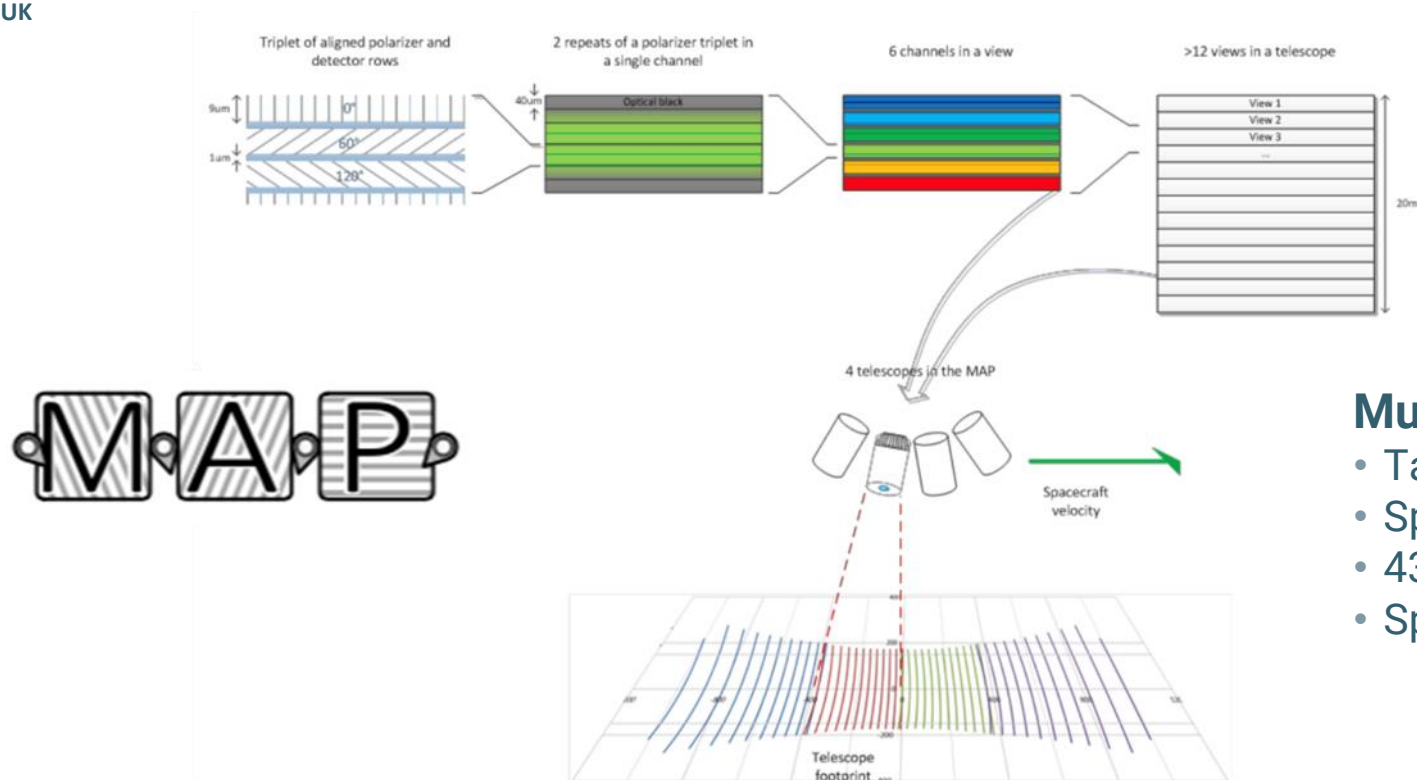
Thank you!



- The CO2M processing system is designed to provide level-1b/c radiance and auxiliary information from three instruments and from all auxiliary data providers as consistent as possible - co-registered and collocated at a common reference grid ("hyper-instrument") and as common input to all CO2M level-2 processors.
- Since different GHG algorithms react differently to the propagation of (complex) information content and deficiencies in instrument performance, robust and reliable results can only be expected from multiple algorithms with significant differences in their exploitation of the overall information content of the overall system (also true for ground-based data retrievals!).
- For CO2M product Cal/Val the accumulation of significant and representative statistics during the course of product commissioning (and to be continued thereafter) is of highest priority in order to discriminate the different bias contributors and to make bias emerge from noise.
- Priority on continuous collection of reference data with high automation, low human resource need and low carbon cost
- Significant use of in-flight accumulated reference data (vicarious statistical and/or from stable well-known targets) for product Cal/Val
- The aim is to re-use existing operational validation and monitoring environments (S4/S5/3MI) in EUMETSAT



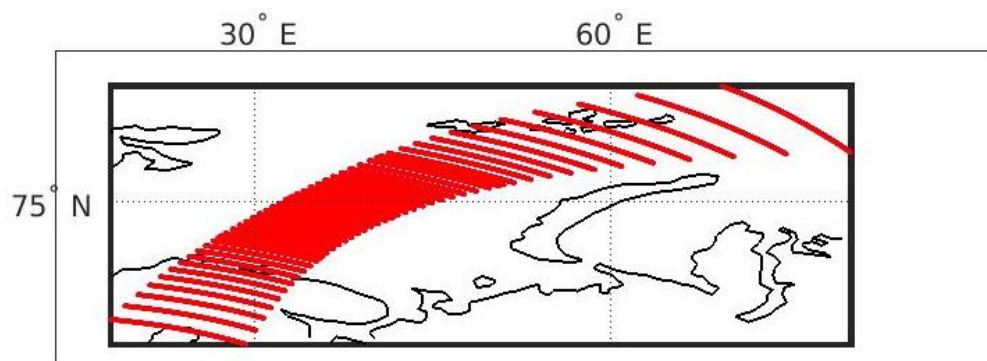
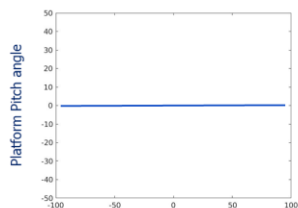
Credit © TAS-UK



Multi-angle polarimeter

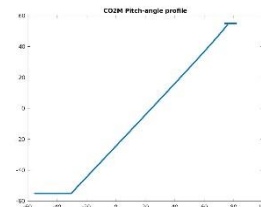
- Target species: **Aerosol**
- Spatial resolution (native): **1 km²**
- 43 views ($0 > \text{OZA} < 60^\circ$) (out of 48 native)
- Spatial resolution (aerosol product): **4 km²**

Nominal Orbit



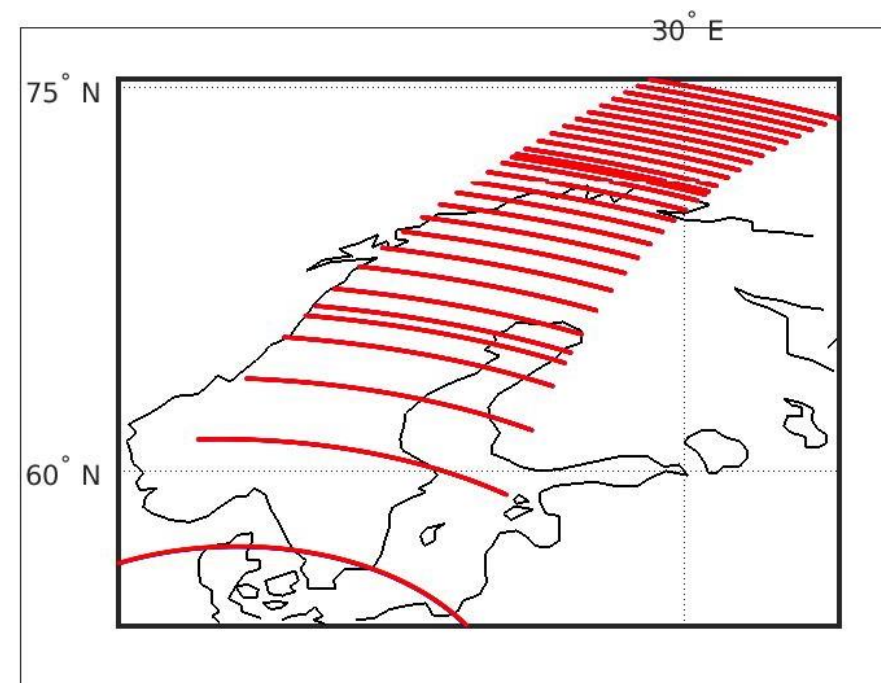
Platform pitch angle at 0 deg
(all 41 views ± 60 degrees)

*)



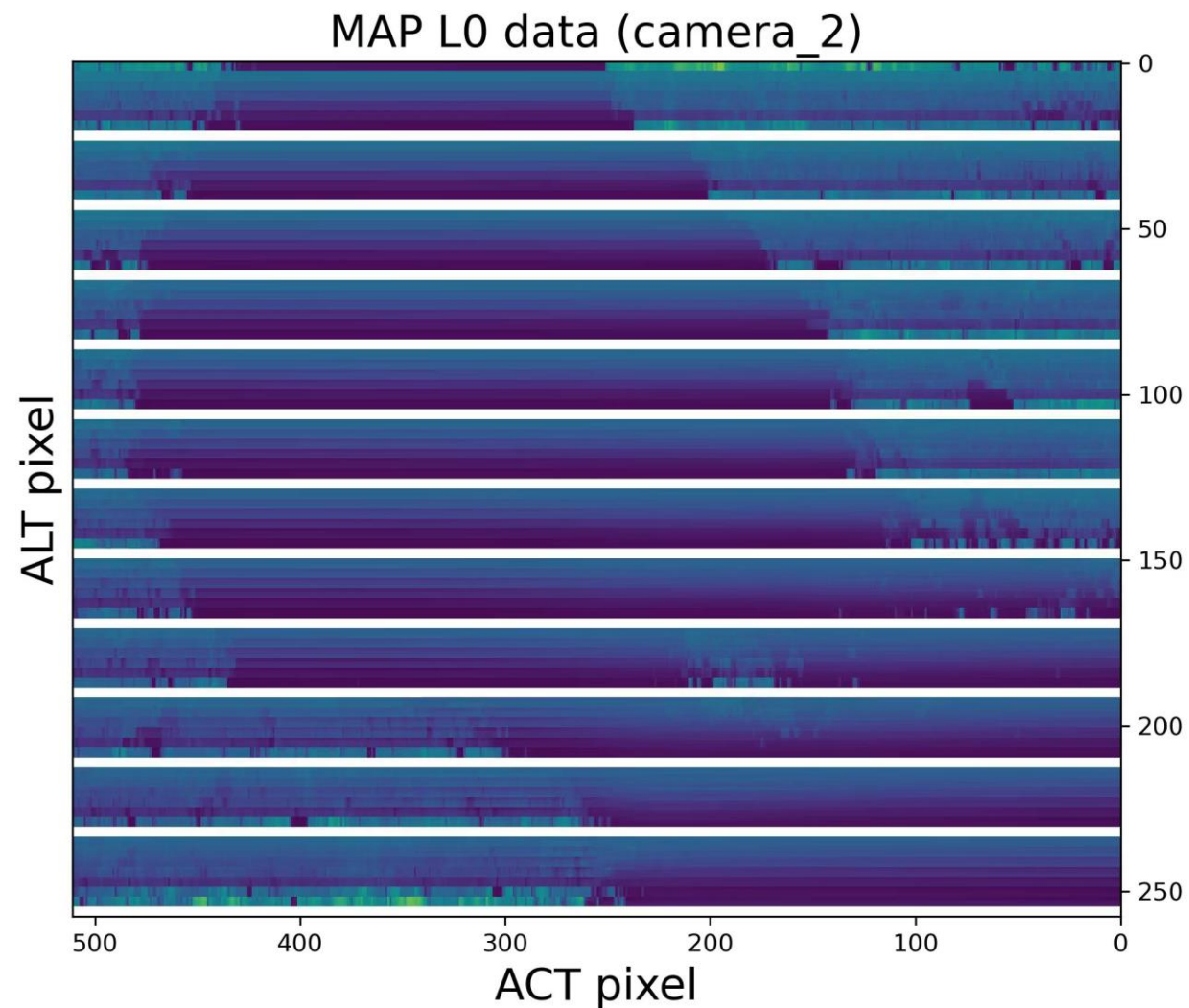
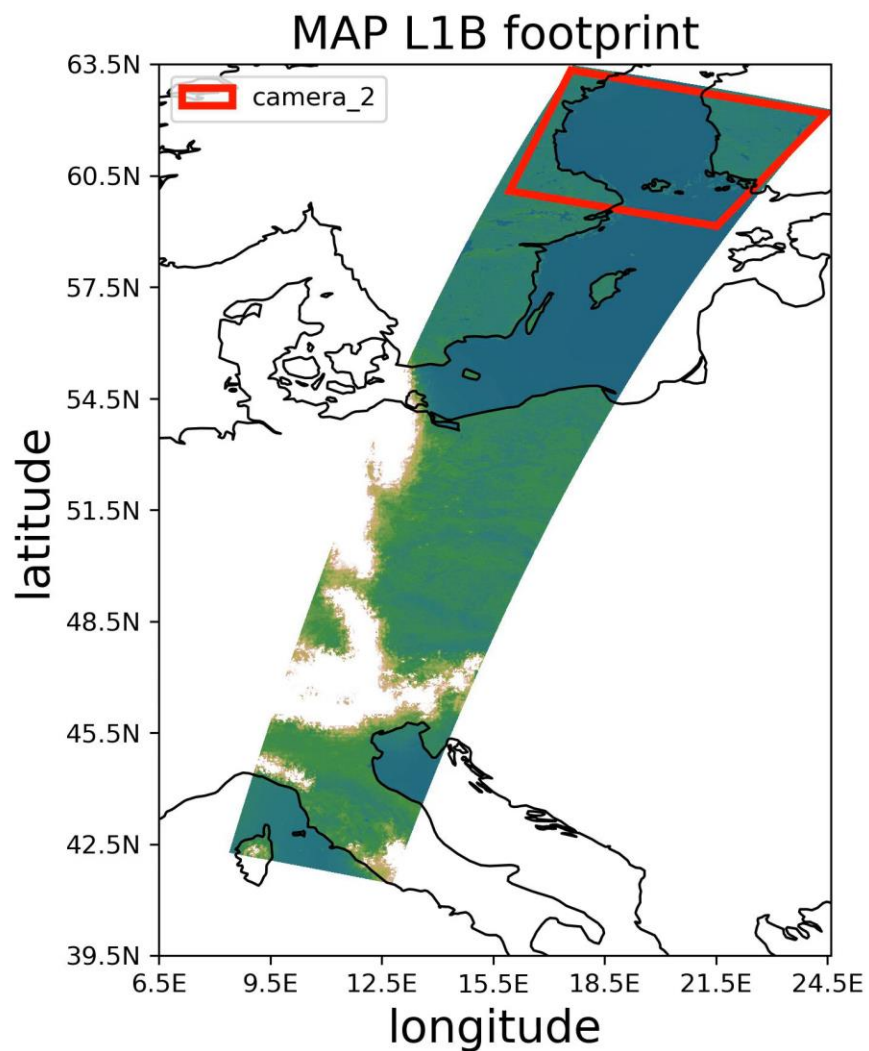
Pitched Platform Orbit

*)



Platform pitch angle at 50 deg forward looking
(all 29 valid views ± 60 degrees)

*) Cox-Munk model for water (glint) reflectance at 7 m/s averaged wind-speed.





Simulation of CO2M MAP L1 data – L1B to L1C co-registration to CO2I grid

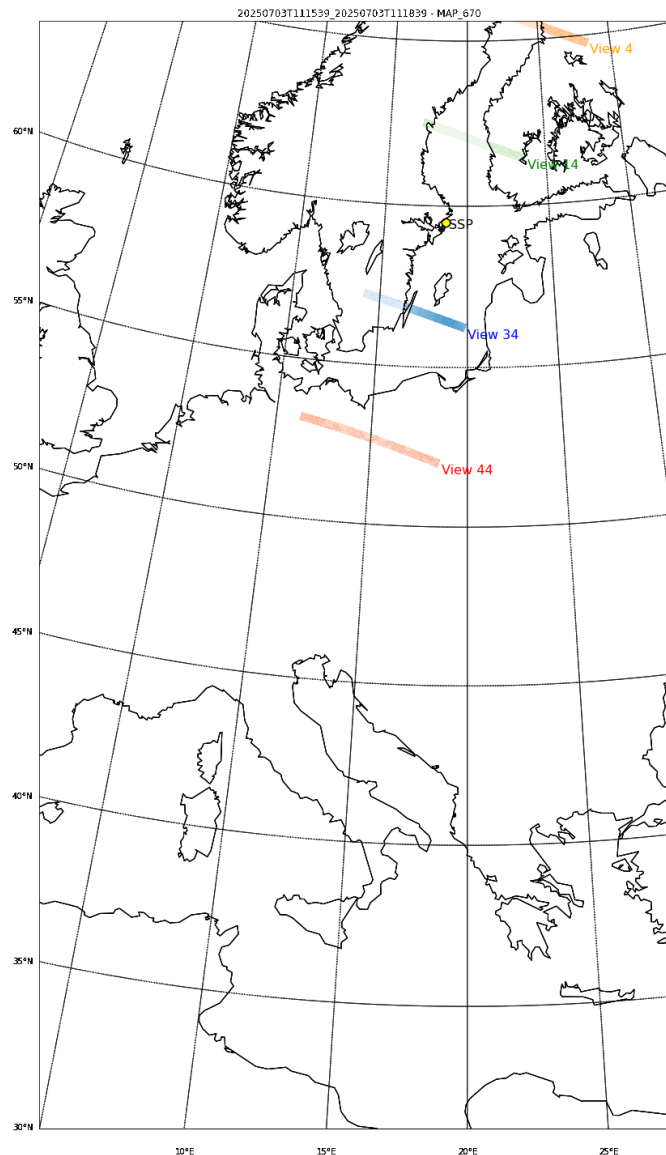
copernicus.eumetsat.int

The CO2M MAP L1B

2 granules
(total 6 minutes)

Nadir pointing

4 views out of 48
are shown

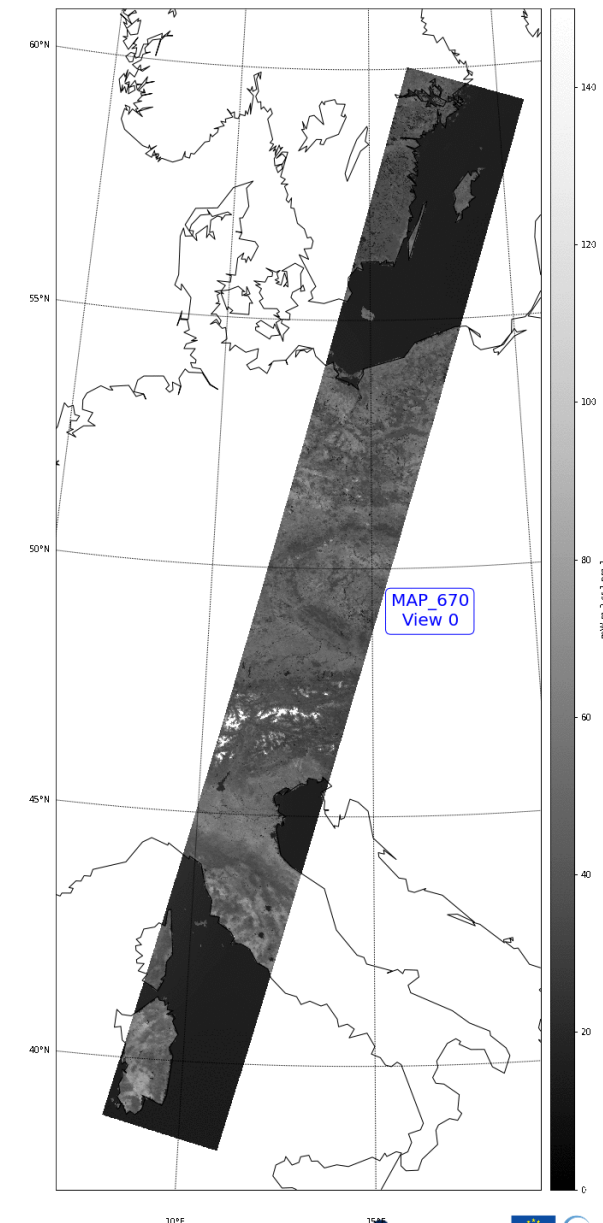


The CO2M MAP L1C

2 granules
(total 6 minutes)

Nadir pointing

45 Co-registered
views

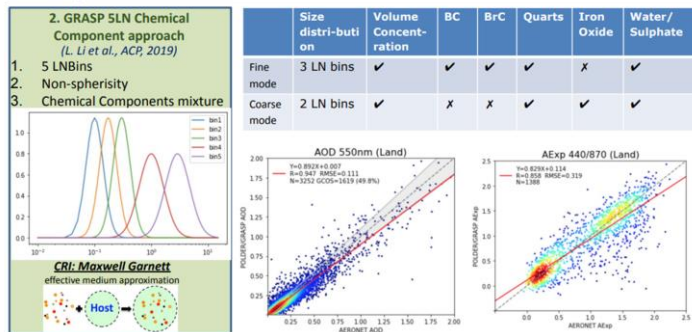




CO2M MAP level-2 aerosol product for pathlength correction

copernicus.eumetsat.int

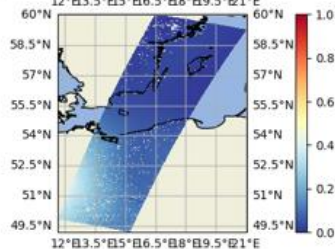
The GRASP/Components aerosol model has been selected for MAP with 3x3 MAP L1C pixels fitted simultaneously.



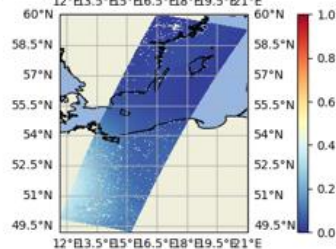
The GRASP (Generalized Retrieval of Aerosol and Surface Properties) is used for the simultaneous retrieval of both aerosol and surface properties.

Aerosol retrieval performed in the VNIR, is used for an atmospheric correction in the SWIR for the CO2 retrieval.

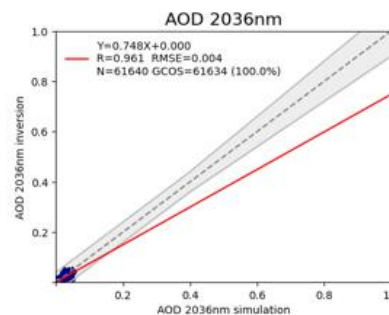
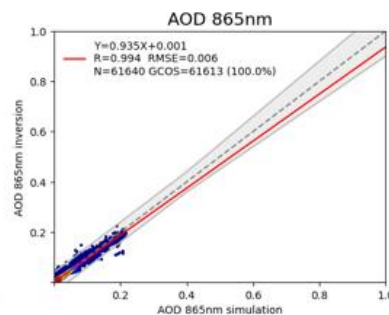
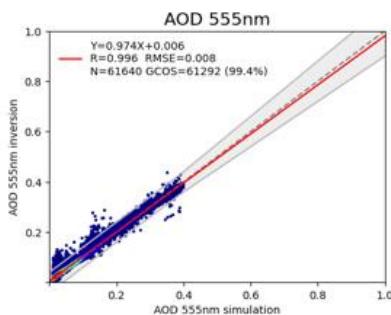
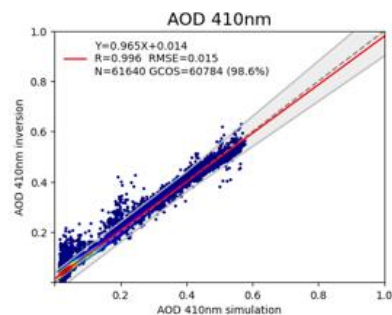
simulation - max_residual=5.0%
min,max=[0.009,0.4] | mean=0.088 | std=0.086
12°E 3.5°E 5°E 6.5°E 8°E 9.5°E 1°E



inversion - max_residual=5.0%
min,max=[0.002,0.436] | mean=0.091 | std=0.084
12°E 3.5°E 5°E 6.5°E 8°E 9.5°E 1°E



simulation-inversion - max_residual=5.0%
min,max=[-0.147,0.108] | mean=-0.004 | std=0.007
12°E 3.5°E 5°E 6.5°E 8°E 9.5°E 1°E

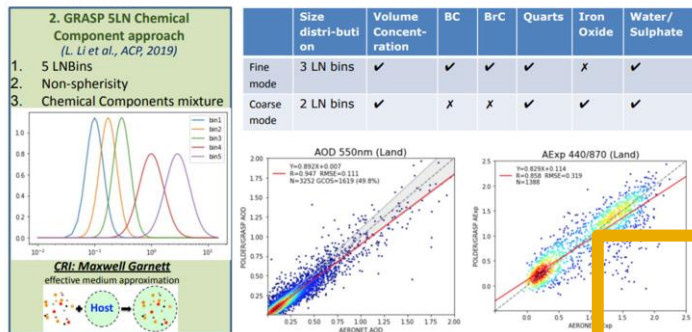




CO2M MAP level-2 aerosol product for pathlength correction

copernicus.eumetsat.int

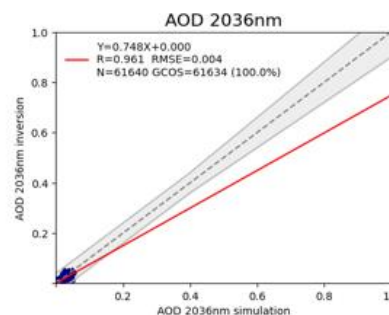
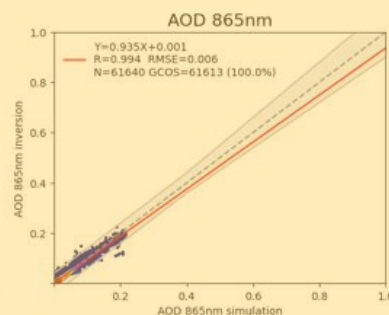
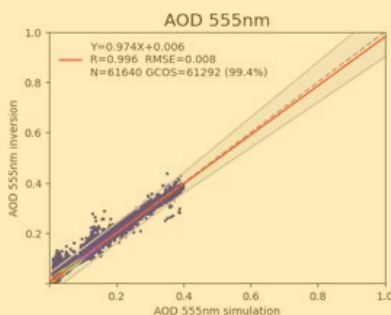
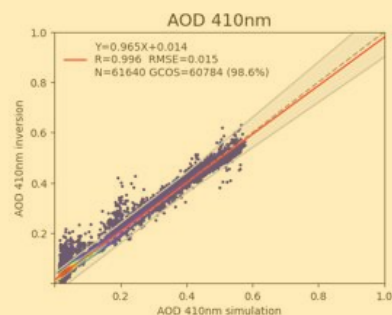
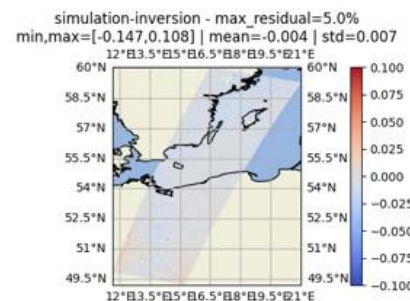
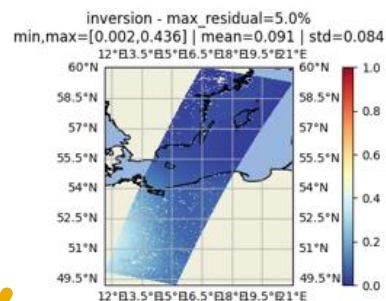
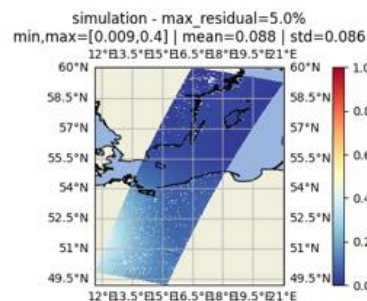
The GRASP/Components aerosol model has been selected for MAP with 3x3 MAP L1C pixels fitted simultaneously.



The GRASP (Generalized Retrieval of Aerosol and Surface Properties) is used for the simultaneous retrieval of both aerosol and surface properties.

Aerosol retrieval performed in the VNIR, is used for an atmospheric correction in the SWIR for the CO2 retrieval.

MAP Band	Wavelength
VNIR-1	410 nm
VNIR-2	443 nm
VNIR-3	490 nm
VNIR-4	555 nm
VNIR-5	670 nm
VNIR-6*	753 nm
VNIR-7	865 nm





EUMETView



EUMETSAT Data store



Data Tailor



EUMETCast Terrestrial



European Weather Cloud

The EUMETSAT catalogue boasts a wide range of data products from several missions including Metop, Meteosat First and Second Generations and Copernicus (Sentinel 3, Sentinel-6).

400TB

Average Volume delivered
Per month

4 million

Products downloaded per month

More than 10 Millions

Items in our catalogue

2.9 PB

Total Products Size

2 Millions

Number of average API calls
served per day

99.8%

Data Store average monthly
availability during last 18 months

200.000

Last peak of daily ingestions
(with reprocessing
campaigns)

**Who's
next?**

Jason-CS
(sentinel 6)
MTG
EPS-SG



EUMETView



EUMETSAT Data store



Data Tailor



EUMETCast Terrestrial



European Weather Cloud

EUMETSAT DATA SERVICES

Cart 0 items

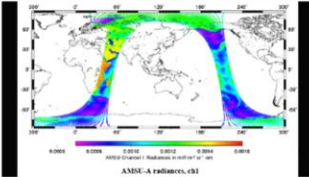
Log in

Data Access / Search results

Data Store

e.g. "Atlantic Sea"

Perform an advanced search >



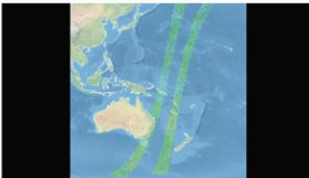
AMSU-A Level 1B - Metop - Global

LEO

The Advanced Microwave Sounding Unit-A (AMSU-A) is a 15-channel microwave radiometer that is used for measuring global atmospheric temperature profiles and will provide information on atmospheric water in all of its phases (with the exception of small ice particles, which are transparent at microwave frequency...

[learn more](#)

Access Data



ASCAT Coastal Winds at 12.5 km Swath Grid - Metop

LEO

Equivalent neutral 10m winds over the global oceans, with specific sampling to provide as many observations as possible near the coasts. Better than using this archived NRT product, please use the reprocessed ASCAT winds data records (EO:EUM:DAT:METOP:OSI-150-A, EO:EUM:DAT:METOP:OSI-150-B). NOTE: From ...

[learn more](#)

Access Data



ASCAT L2 12.5 km Winds Data Record Release 1 - Metop

LEO

The ASCAT Wind Product contains stress equivalent 10m winds (speed and direction) over the global oceans. The winds are obtained through the processing of reprocessed scatterometer backscatter data originating from the ASCAT instrument on EUMETSAT's Metop satellite.

[learn more](#)

Access Data

Browse the catalogue of NRT, historic and CDR collections

53

Introducing the EUMETSAT Data Store



EUMETView



EUMETSAT Data store



Data Tailor



EUMETCast Terrestrial



European Weather Cloud

The screenshot displays the EUMETSAT Data Store web application. The top navigation bar includes the EUMETSAT logo, 'DATA SERVICES', a shopping cart icon with '0 items', a 'Log in' button, and a search icon. Below the navigation bar, the breadcrumb trail reads 'Data Access / Search results'. The main content area is titled 'Data Store' and shows search results for 'AMSU-A Level 1B - Metop - Global'. On the left, a sidebar provides filters for 'AVAILABLE TIME RANGE' (2007-03-01 to 2022-05-25), 'Filename', 'Sort by' (Sensing time, Descending), and 'Filters' (Mission / Satellite, Product type). The main list shows '1-20 of 29 products found' with a table of product details including date, time, mission, and size. A map view on the right shows the Earth with a highlighted region. The bottom footer contains 'CONTACT', 'LEGAL INFORMATION', and social media links.

EUMETSAT DATA SERVICES

Cart 0 items Log in

Data Access / Search results

Data Store

EUMETSAT DATA SERVICES

Cart 0 items Log in

Data Access / Search results / AMSU-A Level 1B - Metop - Global

AMSU-A Level 1B - Metop - Global

ID: EO:EUM:DAT:METOP:AMSUL1
Orbit: LEO
Data Policy: EUMETSAT Meteosat >3hr latency & Metop
[learn more](#)

AVAILABLE TIME RANGE: 2007-03-01 - 2022-05-25

2022-05-24 08:10

2022-05-25 08:10

Filename

Sort by

Sensing time Descending

Filters

Mission / Satellite Product type

Reset Filters Show Results

1-20 of 29 products found

Select all in page Add selected to Cart

☐	2022-05-25 (06:28) - 2022-05-25 (08:10)	Metop-B	1.52 MB		
☐	2022-05-25 (05:40) - 2022-05-25 (07:22)	Metop-C	1.59 MB		
☐	2022-05-25 (04:46) - 2022-05-25 (06:28)	Metop-B	1.52 MB		
☐	2022-05-25 (03:55) - 2022-05-25 (05:40)	Metop-C	1.64 MB		
☐	2022-05-25 (03:01) - 2022-05-25 (04:46)	Metop-B	1.56 MB		
☐	2022-05-25 (02:13) - 2022-05-25 (03:55)	Metop-C	1.59 MB		
☐	2022-05-25 (01:19) - 2022-05-25 (03:01)	Metop-B	1.52 MB		
☐	2022-05-25 (00:31) - 2022-05-25 (02:13)	Metop-C	1.59 MB		
☐	2022-05-24 (23:37) - 2022-05-25 (01:19)	Metop-B	1.52 MB		
☐	2022-05-24 (22:49) - 2022-05-25 (00:31)	Metop-C	1.59 MB		
☐	2022-05-24 (21:55) - 2022-05-24 (23:37)	Metop-B	1.51 MB		
☐	2022-05-24 (21:07) - 2022-05-24 (22:49)	Metop-C	1.59 MB		
☐	2022-05-24 (20:13) - 2022-05-24 (21:55)	Metop-B	1.52 MB		

CONTACT **LEGAL INFORMATION**

Follow us

Search data in a collection matching your date&time and ROI selection

Customize data with the Data Tailor or download the product file directly.



EUMETView



EUMETSAT Data store



Data Tailor



EUMETCast Terrestrial



European Weather Cloud

Data Store Interfaces

Online interface

- 1 Download API
- 2 OpenSearch API
- 3 REST API
- 4 Subscription API (coming soon)

- 1 Download data using URL, command line and Python based options using ID or collection and sensing time
- 2 Search Data Store at product and collection levels. Filter selections by time, ROI, satellite, timeliness
- 3 Navigate/Browse products and collections by date and spatial coverage / footprint
- 4 Notification service for new product availability



Python and Jupyter notebook examples snippets available for each API



SwaggerTM

Discovery

POST /csw/record/_search

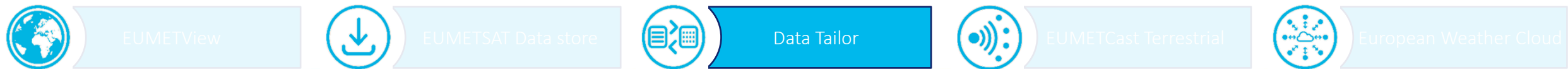
OPTIONS /csw/record/_search

GET /csw/record/_search

GET /csw/_search

POST /csw/_search

GET /csw/record/*



The **EUMETSAT Data Tailor** allows users to subset and aggregate our data products in space and time, filter layers, generate quicklooks, re-project, and reformat into common GIS formats (netCDF, GeoTIFF, etc.). It offers a uniform way to transform both historical and near real-time satellite data provided by EUMETSAT.



Service available via Data Store and as standalone tool



EUMETView



EUMETSAT Data store



Data Tailor



EUMETCast Terrestrial



European Weather Cloud

Using the CLI and API (local)

- The standalone Data Tailor can also be run using a **command line interface** (CLI) or a Python **application programming interface** (API);
 - Allowing for use without GUI
 - Supports more complex processing chains (e.g. with PyTroll)

The Web REST API (remote)

- Provides a REST web interface than can be invoked from other applications

```
1 epct run-chain \  
2   -f test-customisation.yaml \  
3   AVHR_xxx_1B_M01_20180120003103Z_20180120003403Z_N_0_20180120004248Z \  
4   --target-dir
```

```
1 from epct import api  
2  
3 INPUT_FILENAME = 'AVHR_xxx_1B_M01_20180120003103Z_20180120003403Z_N_0_20180120004248Z'  
4 chain_config = {'product': 'AVHRR_L1', 'format': 'netcdf4'}  
5  
6 output_files = api.run_chain(  
7     [INPUT_FILENAME],  
8     chain_config=chain_config,  
9     target_dir='results'  
10 )
```

GET	/customisations
POST	/customisations
GET	/customisations/{customisationId}
PUT	/customisations/{customisationId}
GET	/customisations/{customisationId}/log
GET	/products



Python and Jupyter notebook examples snippets available for each API



Swagger™



EUMETView



EUMETSAT Data store



Data Tailor



EUMETCast Terrestrial



European Weather Cloud

• EUMETSAT Data Access Client

• Python library

- Browsing, searching and downloading data through Data Store APIs
- Tailoring and processing data through Data Tailor API
- 🐡 reduces the code to be written by over 60%

• Command-line utilities

- Browsing, searching and downloading data through Data Store APIs
- **New:** Create and manage Data Tailor jobs
- **New:** Create and manage subscriptions

```
$ pip install eumdac
```

```
$ conda install -c eumetsat eumdac
```



Download for
MacOS



Download for
Windows



Download for
Linux

```
(base) PS C:\Users\Jordan> eumdac
usage: eumdac [-h] [--version] [--set-credentials ConsumerKey ConsumerSecret] [--debug]
              {describe,search,download,subscribe} ...

EUMETSAT Data Access Client

positional arguments:
  {describe,search,download,subscribe}
  describe              describe a collection or product
  search                search for products at the collection level
  download               download product(s) from a collection
  subscribe              subscribe a server for a collection

optional arguments:
  -h, --help            show this help message and exit
  --version              show program's version number and exit
  --set-credentials ConsumerKey ConsumerSecret
                        permanently set consumer key and secret and exit, see
                        https://api.eumetsat.int/api-key
  --debug               show backtrace for errors

(base) PS C:\Users\Jordan>
```


- Wide variety of new EUMETSAT data services are now available for different needs of our users
- Feel free to try and start to use them.
- More resources on the internet
 - EUMETSAT Knowledge Base : <https://eumetsatspace.atlassian.net/wiki/spaces/EUM/overview>
 - EUMETSAT Youtube Channel : <https://www.youtube.com/channel/UCiN59j5b1fAGnXVzIYFpaMw>
- Helpdesk (ops@eumetsat.int) can be contacted for any question or inquiry.



- CO2M Level 2 products will be made available from the EUMETSAT Data Store
- Data tailoring is principally possible and interfaces available for CO2M level-2 user products via the EUMETSAT data portal
- Specific tailoring needs for Co2M to be however defined with EUMETSAT data-service (feasibility analysis)!
- CO2M team will start interacting with portal-team to create a set of demonstrators to be presented to MAG – **MAG invited to comment/recommend**
- ***Reminder:*** GHG level-2 standard product sample available on MAG server