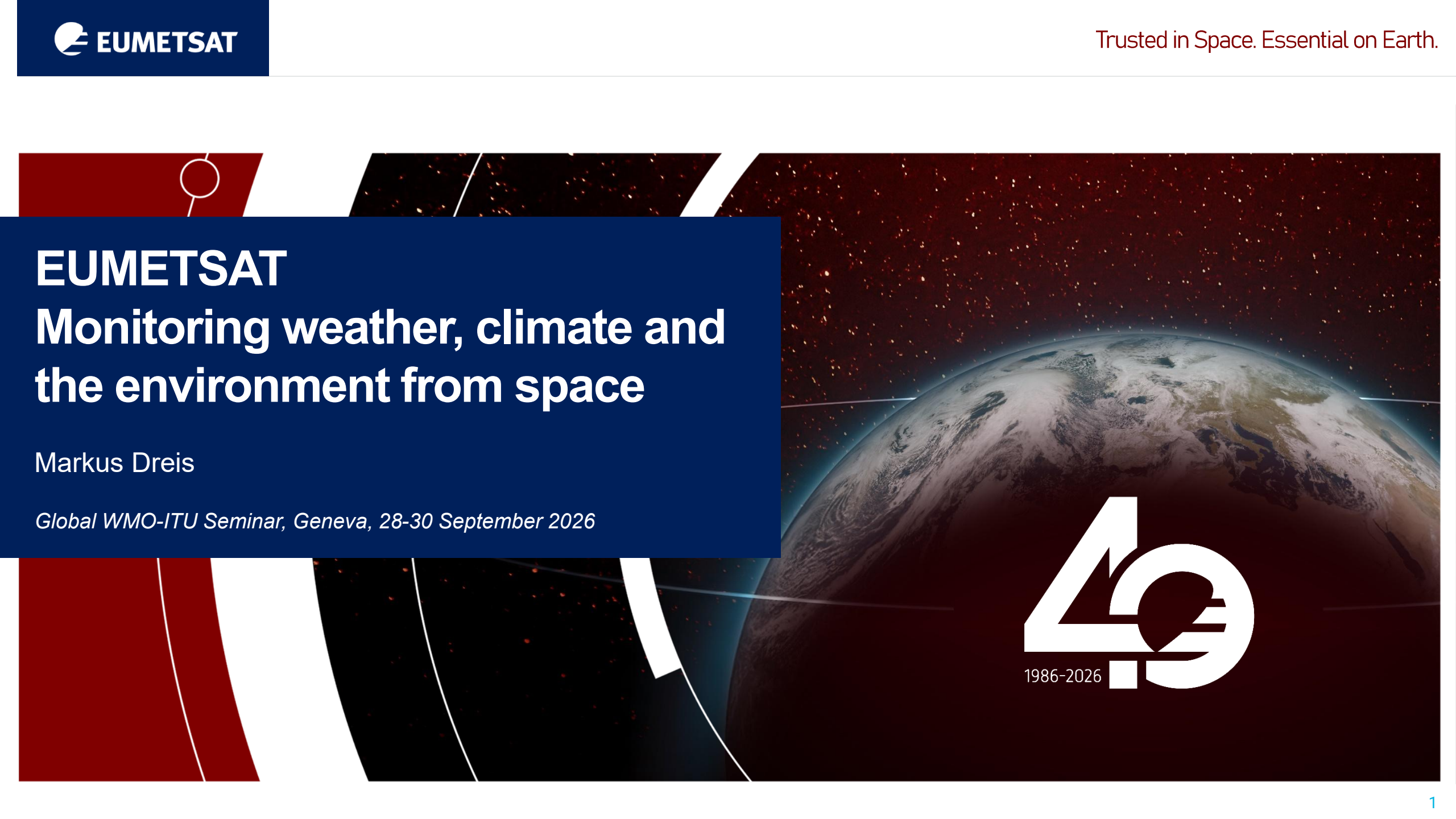




EUMETSAT

Monitoring weather, climate and the environment from space

Markus Dreis

Global WMO-ITU Seminar, Geneva, 28-30 September 2026





An intergovernmental organisation with 30 member states





Primary objective:

Establish, maintain and exploit European systems of meteorological satellites.

For this we operate a system of meteorological satellites that observe the atmosphere and ocean and land surfaces – 24 hours a day, 365 days a year, serving the needs of its member state for timely and accurate weather and climate data.

Further objective:

Contribute to the operational monitoring of the climate and the detection of global climatic changes, exploiting four Sentinel missions of the Copernicus space component dedicated to the monitoring of atmosphere, ocean and climate.



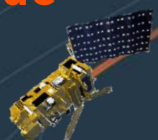
The need for two types of meteorological satellites

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...to fulfil the EUMETSAT mission objectives!

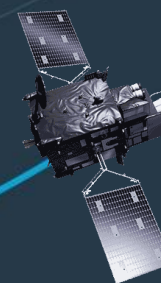
**Low-Earth orbit at
650-850 km altitude**

Critical for
forecasts
up to 10 days in
advance



**Geostationary orbit
at 36000km altitude**

Vital for forecasts up
to a few hours ahead





We observe weather & climate from LEO, GEO and inclined orbits

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SENTINEL-3A & -3B (98.7° incl.)

Low Earth, sun-synchronous orbit
Copernicus satellites delivering marine data services from 814km altitude

JASON-3 (63° incl.)

Low Earth, non-synchronous orbit
Copernicus ocean surface topography mission (shared with CNES, NOAA, NASA and Copernicus)

Sentinel-6 Michael Freilich (66° incl.) Sentinel-6B (launched November 2025)

Low Earth, non-synchronous orbit
Copernicus ocean surface topography mission (shared with NASA, NOAA, ESA and Copernicus with support from CNES)

METEOSAT-10, -11

Geostationary orbit

Meteosat Second Generation

Two-satellite system

Full disc imagery mission (15 mins)

(Meteosat-11 (9.5° E))

Rapid scan service over Europe (5 mins)
(Meteosat-10 (0°))

METEOSAT-9 (45.5° E)

Geostationary orbit

Meteosat Second Generation
providing Indian Ocean data coverage

METOP-B & -C (98.7° incl.)

Low Earth, sun-synchronous orbit

EUMETSAT Polar System (EPS)/
Initial Joint Polar System

METOP-SGA1 (98.7° incl.)

Low Earth, sun-synchronous orbit

EUMETSAT Polar System Second
Generation (EPS-SG) / Joint Polar System

Meteosat-12 (8°) & Meteosat-13 (0°)

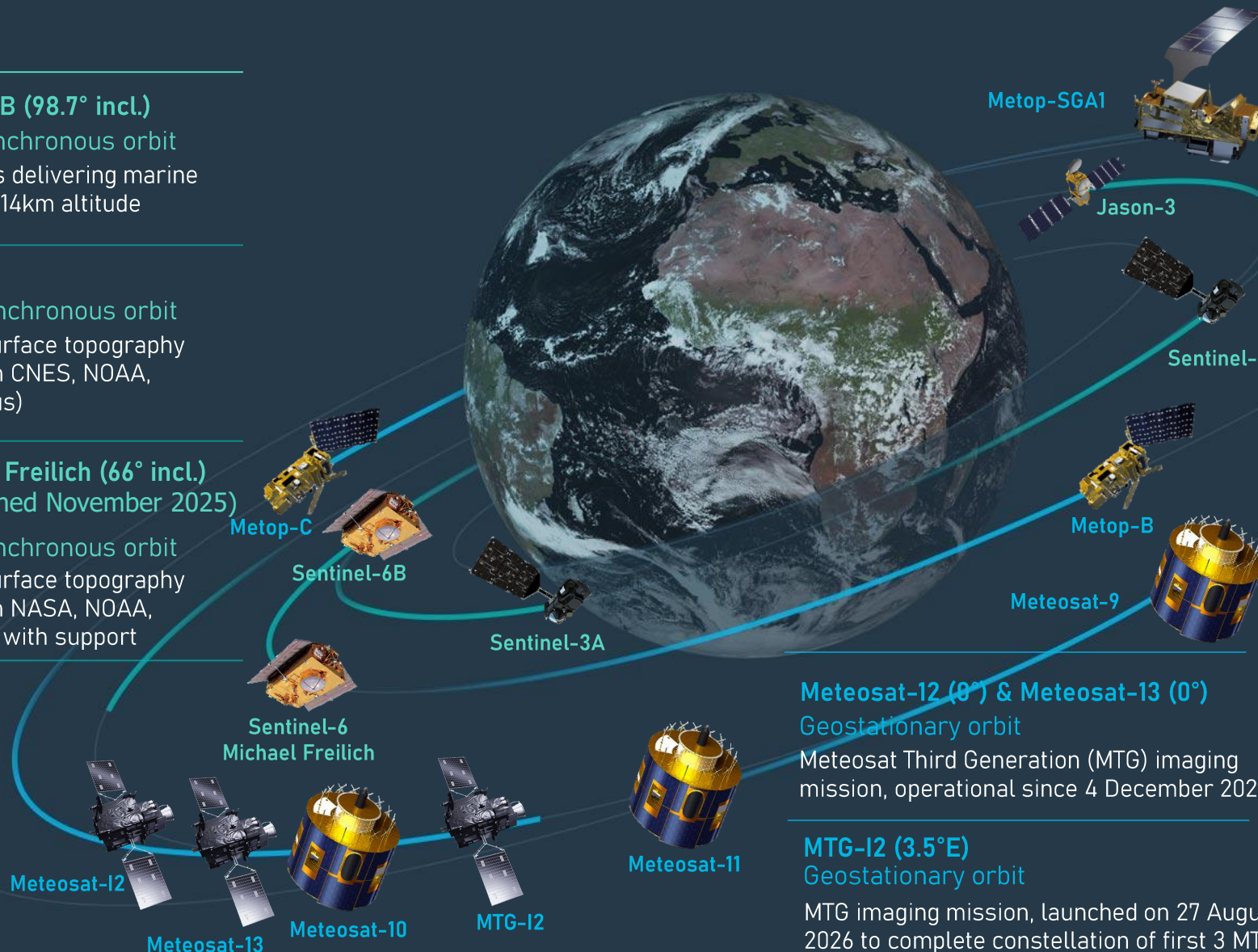
Geostationary orbit

Meteosat Third Generation (MTG) imaging mission, operational since 4 December 2024

MTG-I2 (3.5°E)

Geostationary orbit

MTG imaging mission, launched on 27 August 2026 to complete constellation of first 3 MTG satellites

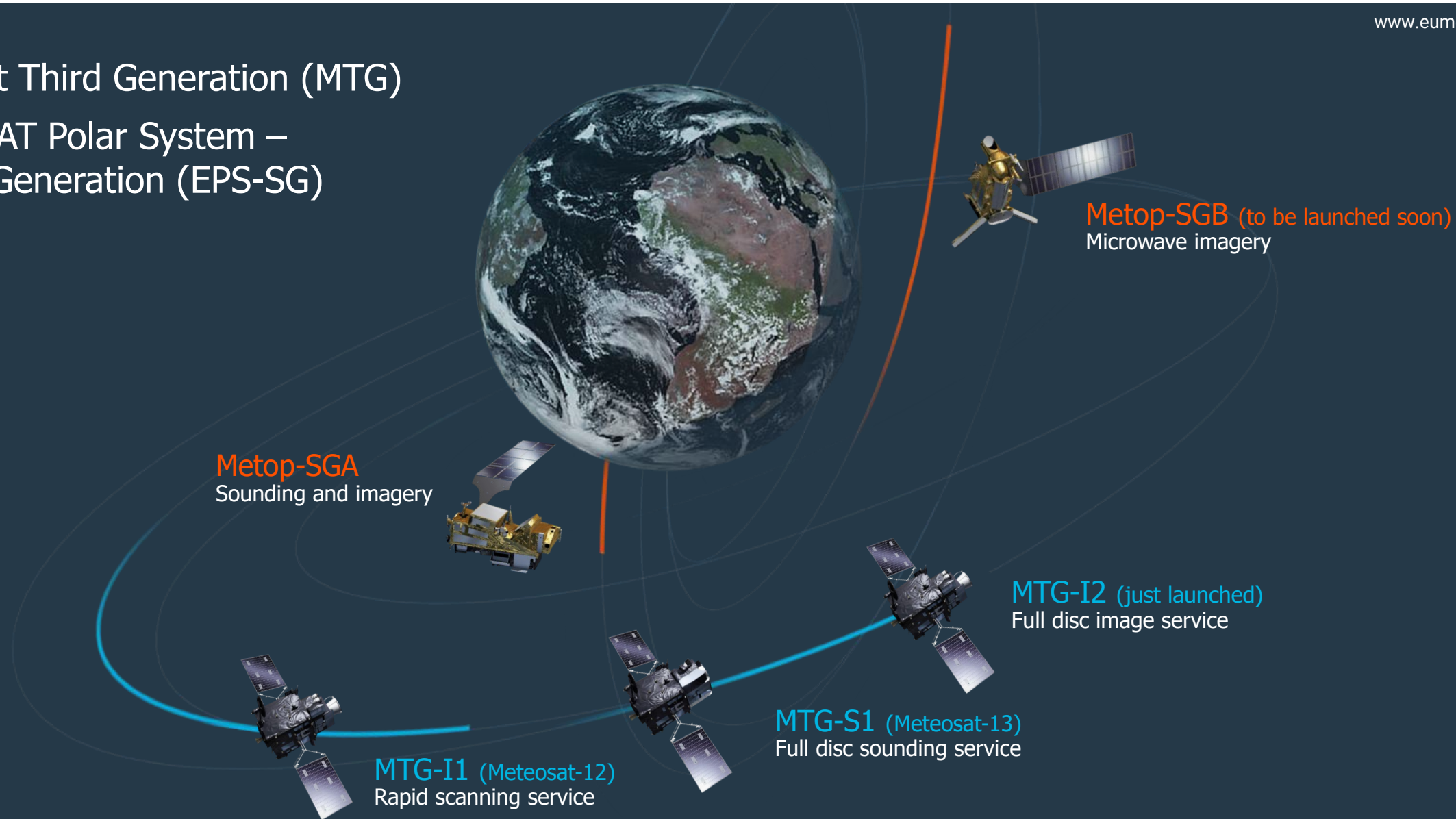




Future focus: two highly innovative programmes that have already started!

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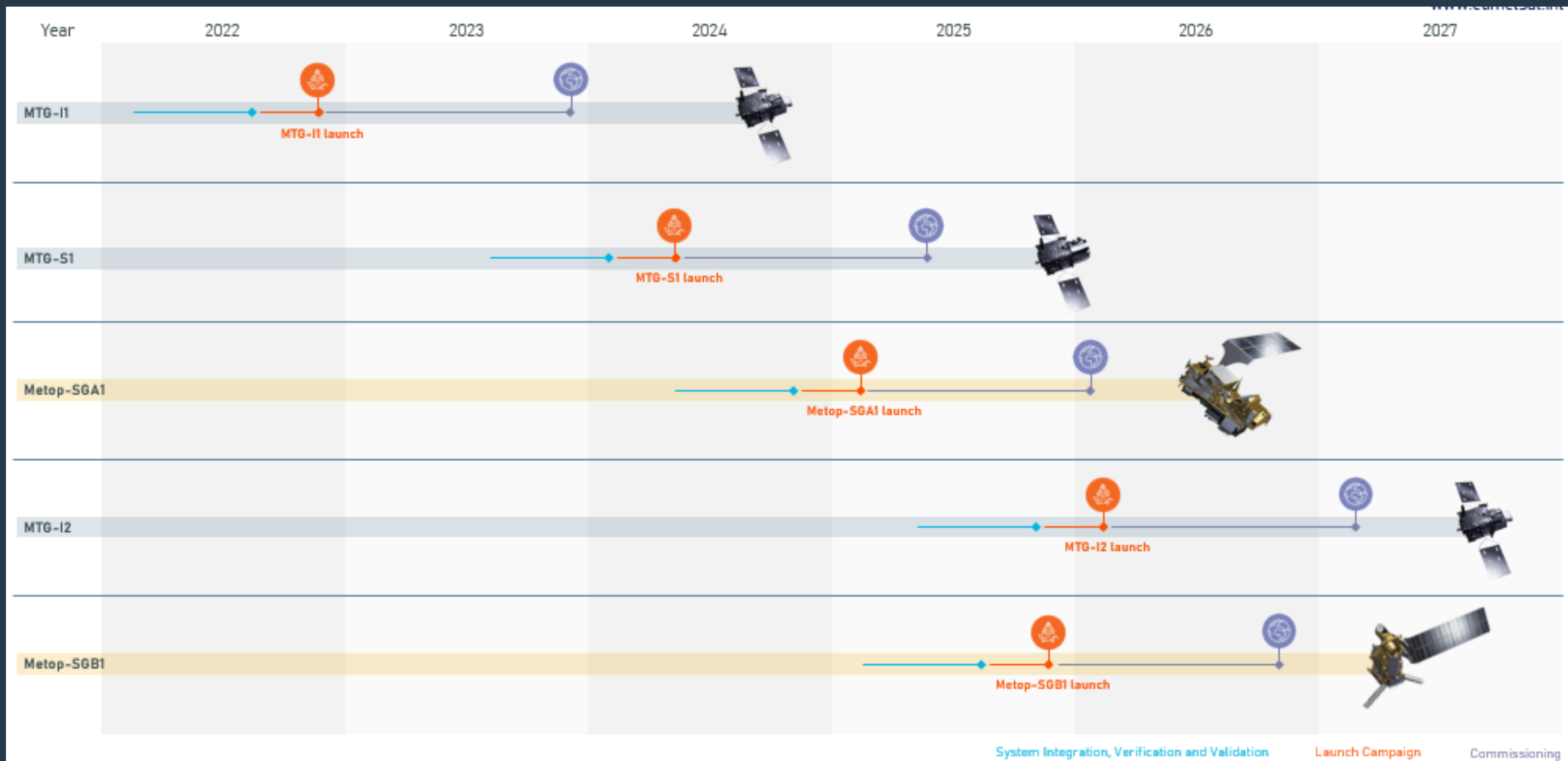
- Meteosat Third Generation (MTG)
- EUMETSAT Polar System – Second Generation (EPS-SG)





Launch of next-generation satellites 2022-2027

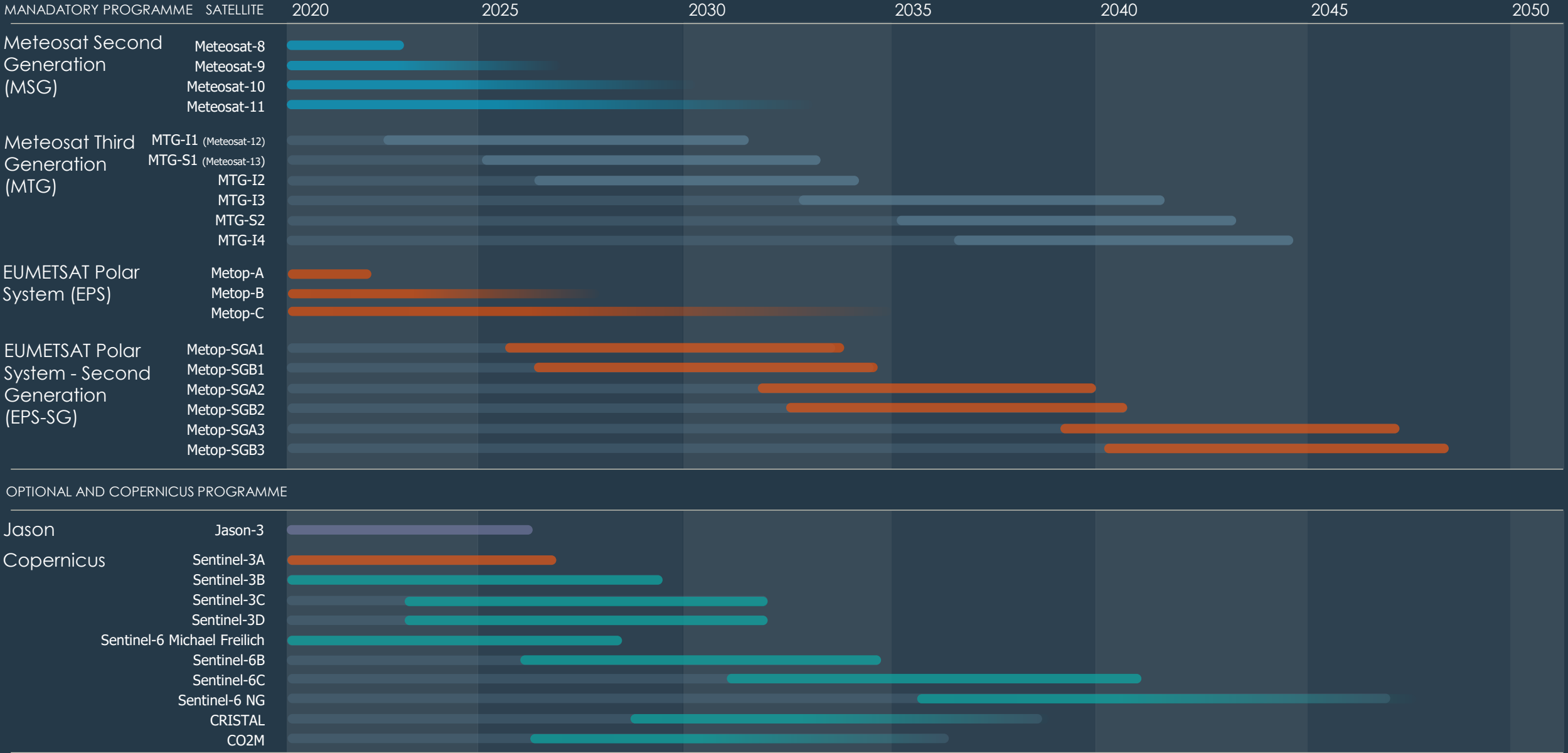
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EUMETSAT mission planning – a long-term perspective

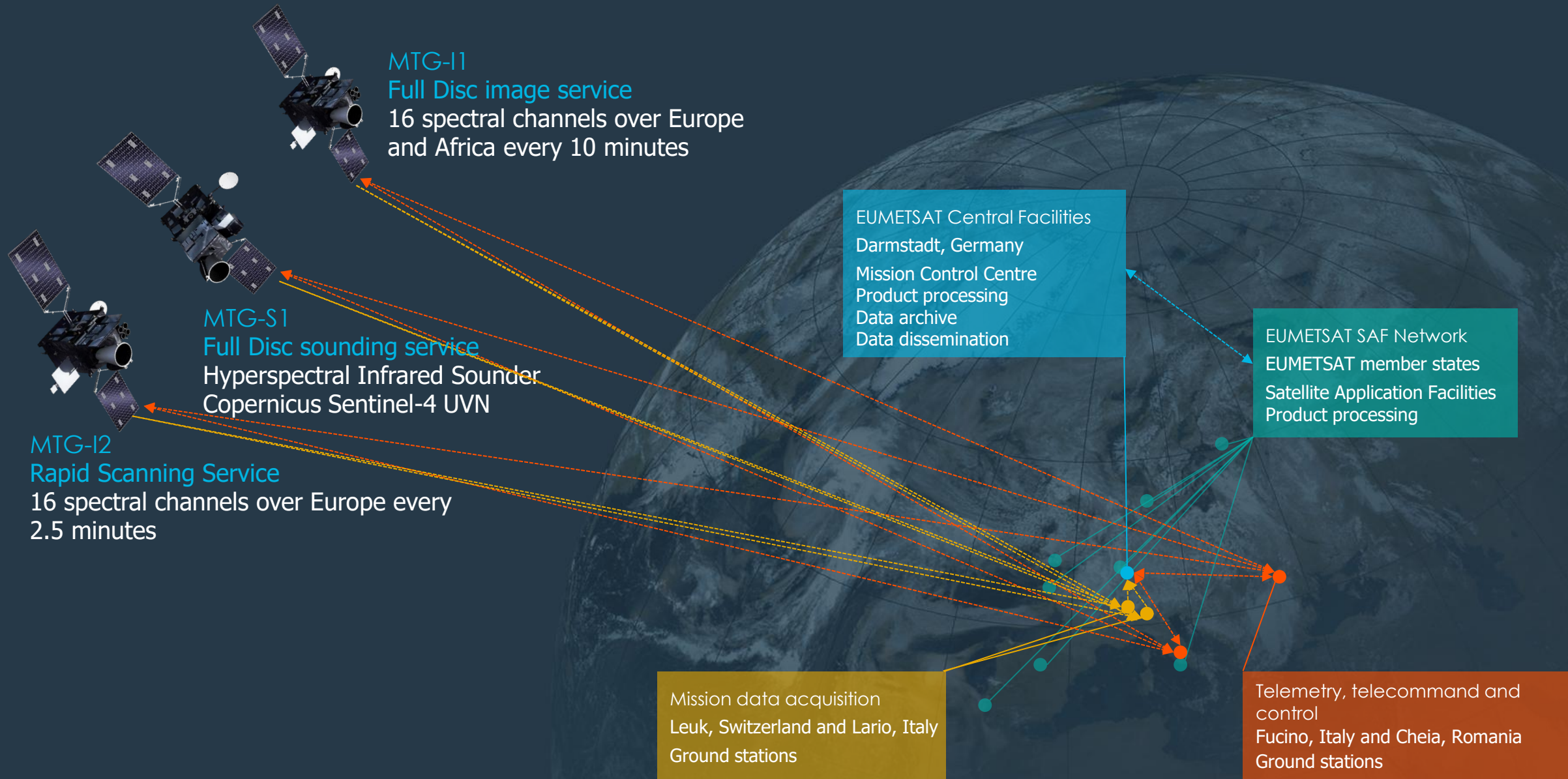
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Meteosat Third Generation

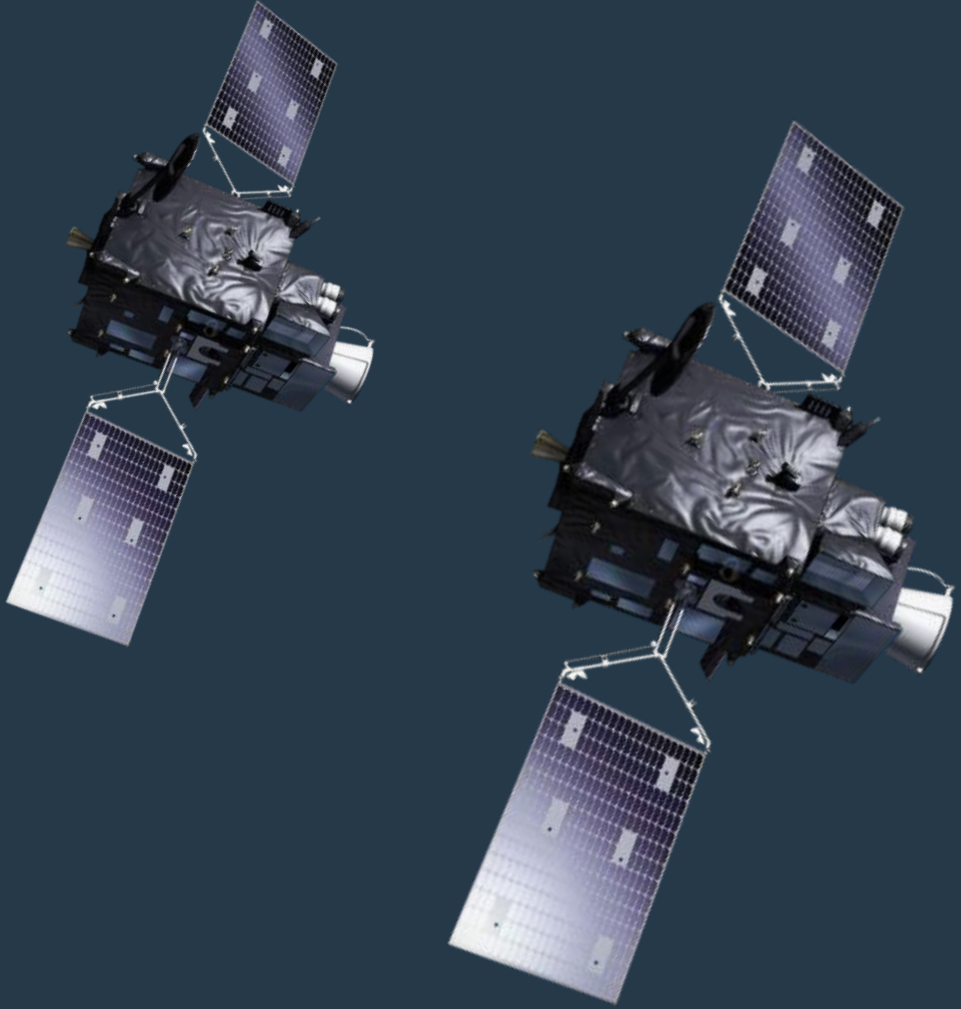
www.eumetsat.int



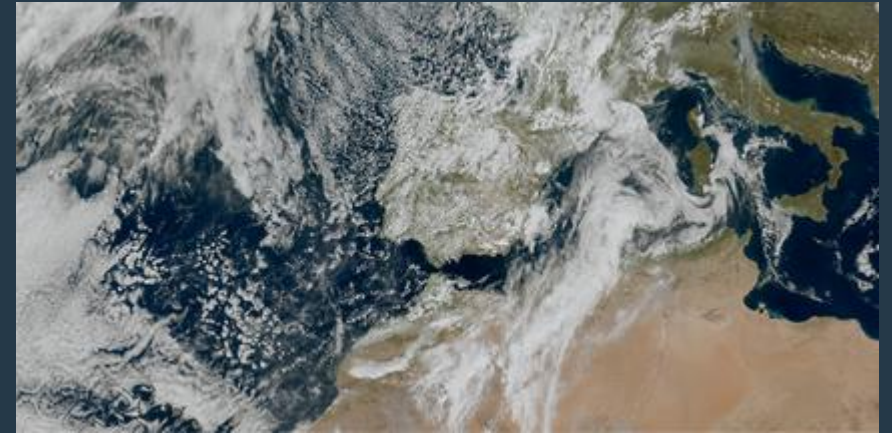


MTG-I imaging mission

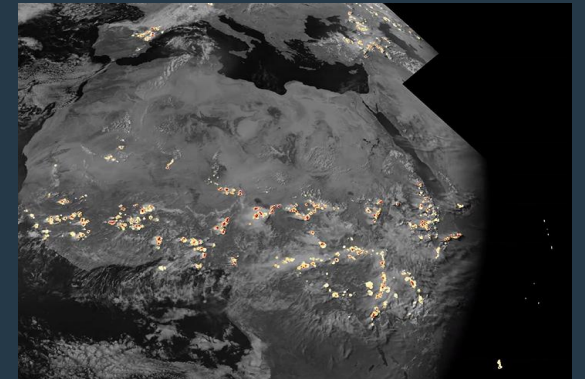
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- Imagery mission (Flexible Combined Imager (FCI)) implemented by two MTG-I satellites:
 - MTG-I1: Full disc imagery every 10 minutes in 16 spectral bands (MSG: every 15 minutes in 12 channels)
 - MTG-I2: Fast imagery of Europe every 2.5 minutes (MSG: every 5 minutes)



- New Lightning Imager (LI)

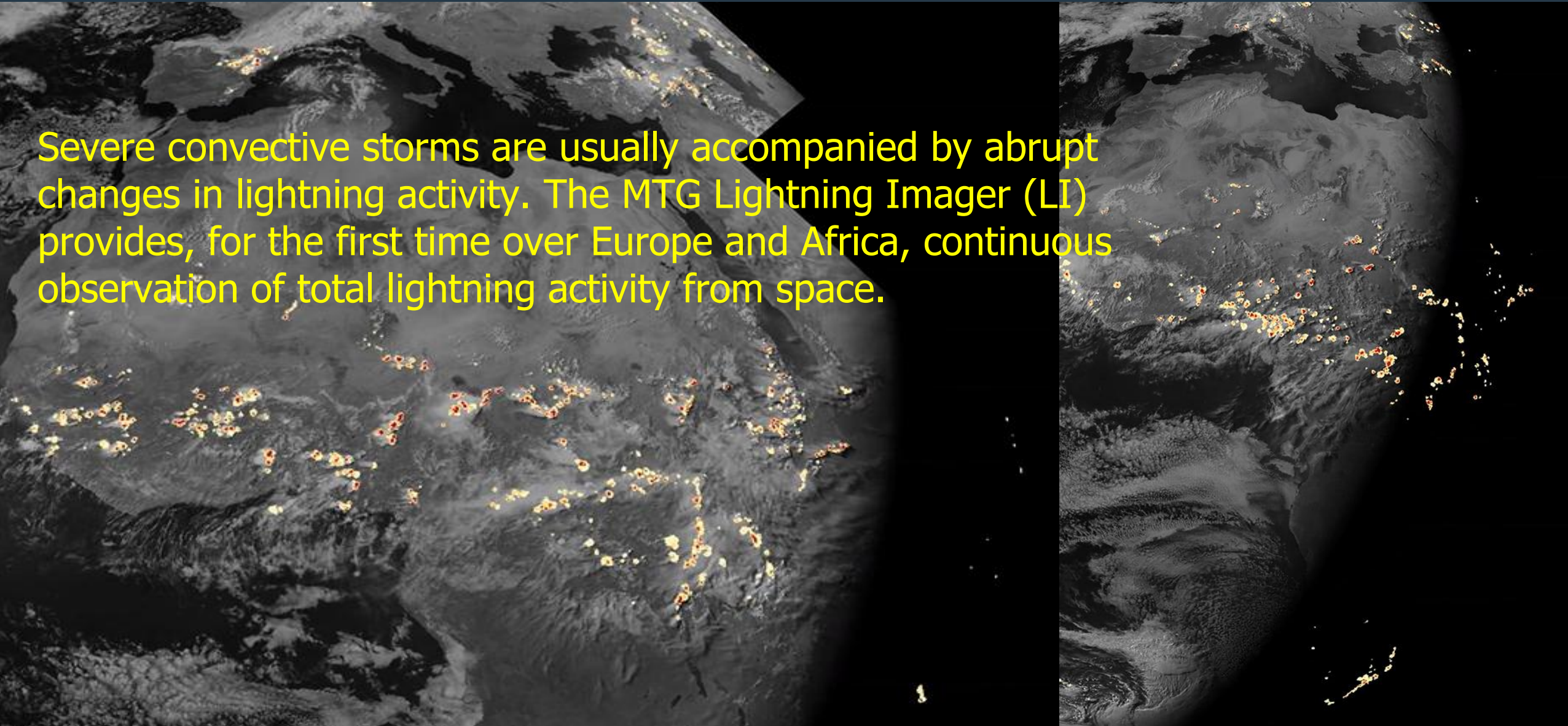


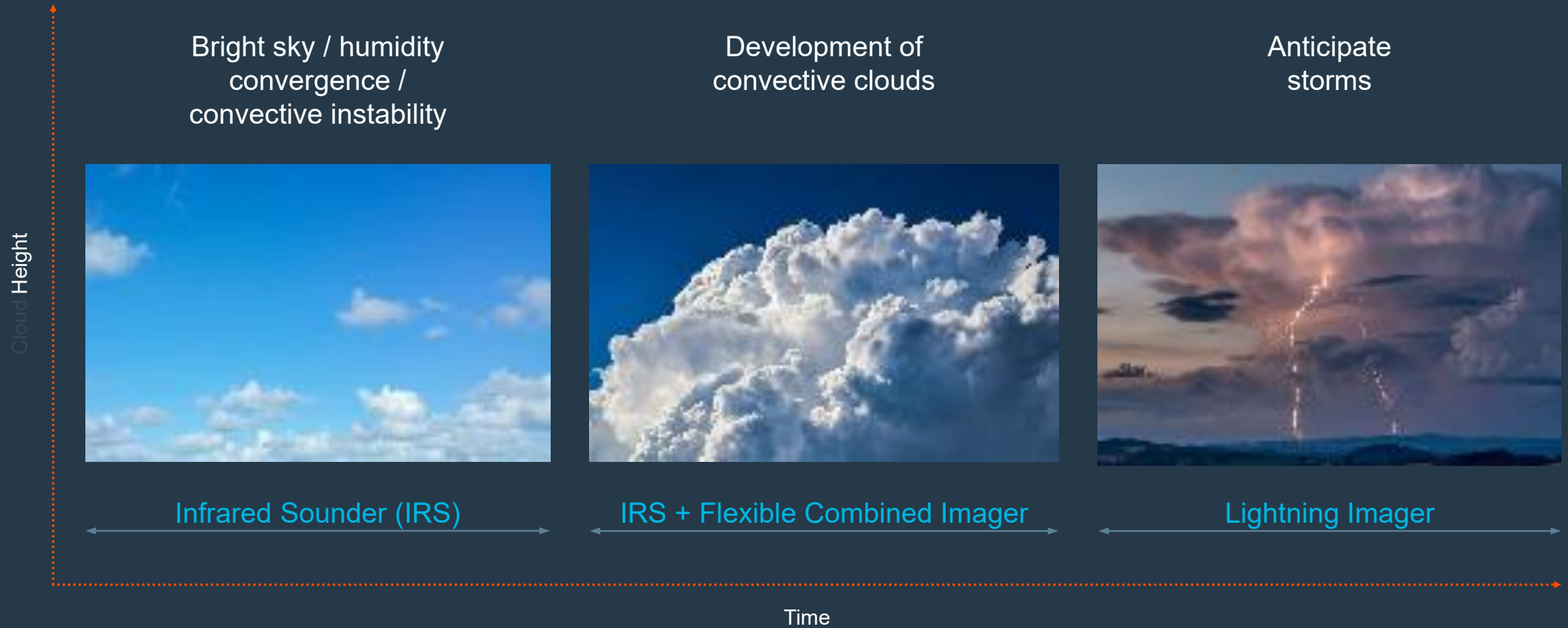


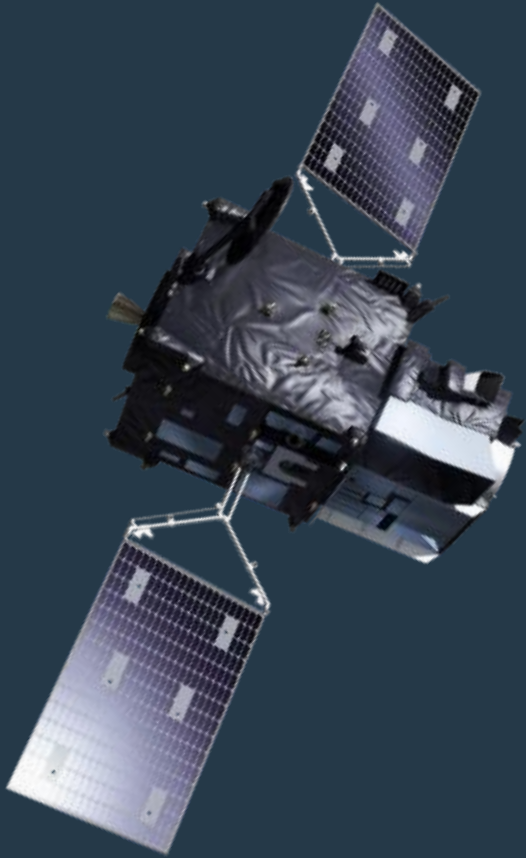
MTG-I: new lightning imagery mission

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Severe convective storms are usually accompanied by abrupt changes in lightning activity. The MTG Lightning Imager (LI) provides, for the first time over Europe and Africa, continuous observation of total lightning activity from space.

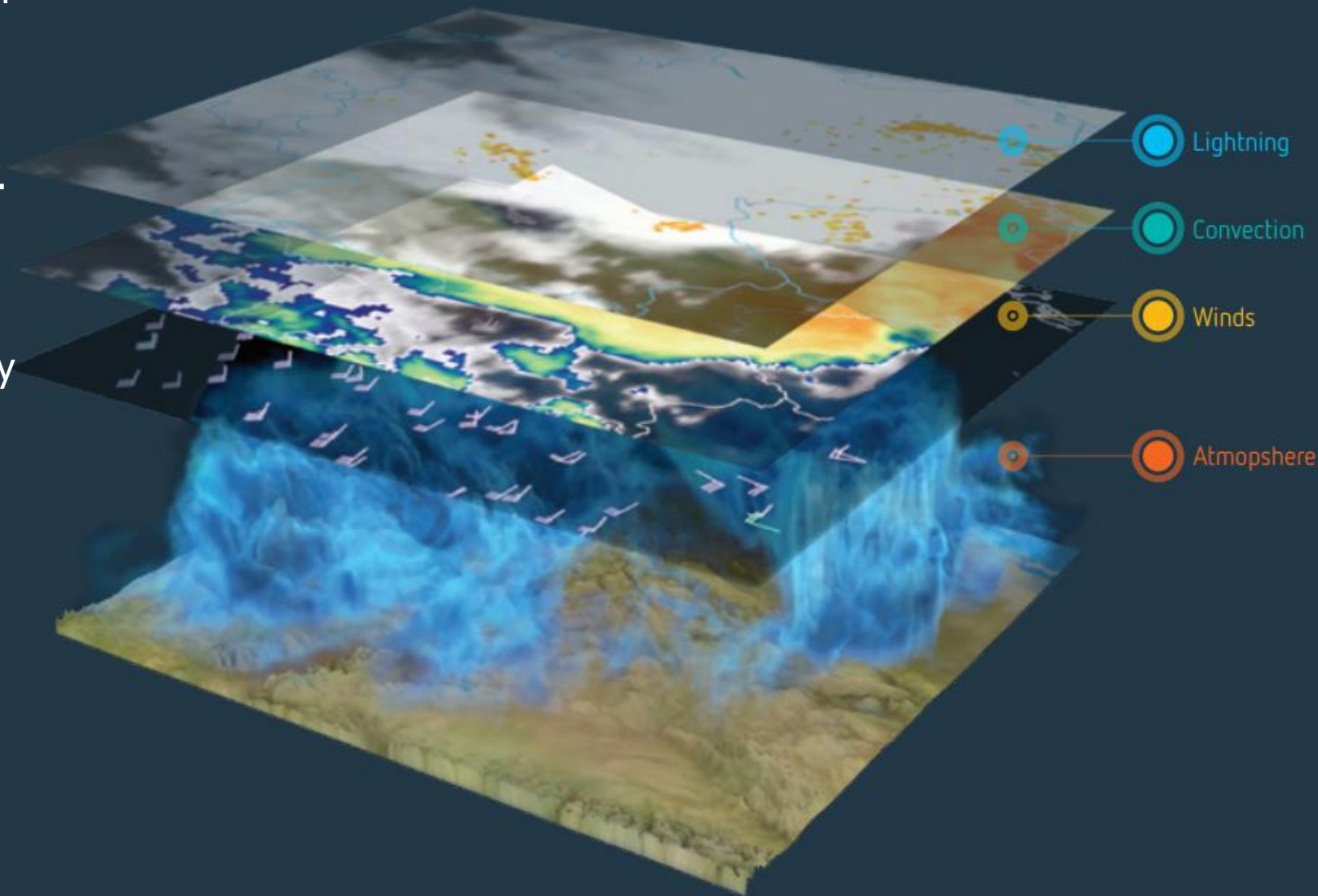






- Hyperspectral infrared sounding mission implemented by two MTG-S satellite, providing vertical profiles of temperature, moisture, and aerosols in the atmosphere
- 4D weather cube: temperature, water vapour, O_3 , every 30 minutes over Europe, 1/4 of the Earth disc every fifteen minutes and taking around 2000 infrared images in this process, enabling experts to generate temperature and humidity maps that will significantly improve precipitation forecasts.
- Air quality monitoring and atmospheric chemistry by the Copernicus Sentinel-4 Ultraviolet, Visible and Near-Infrared Sounder instrument

- MTG's scientific instrumentation will enable meteorologists to simultaneously track phenomena such as convection, winds, and lightning activity in space and time.
- This will support national meteorological and hydrological services in early detection of rapidly developing, high-impact weather events such as severe storms.
- This artist's impression depicting a 4D weather cube provides a snapshot of how a diversity of observations are brought together to probe the atmosphere in near-real time with a high repeat cycle.



A little bit of history – First Meteosat image in 1977



METEOSAT-1

FIRST IMAGE: 9 DEC 1977
COPYRIGHT ESA

With the launch of the first Meteosat satellite on 23 November 1977, Europe gained the ability to gather weather data over its own territory with its own satellite.

Meteosat began as a research programme for a single satellite by the European Space Research Organisation, a predecessor of the European Space Agency (ESA).

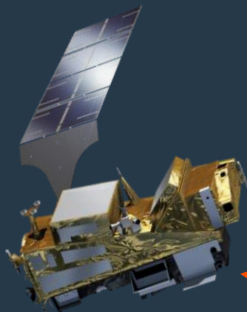
Once the satellite was in orbit, the immense value of the images and data it provided led to the move from a research to an operational mission requiring a dedicated organisation to conduct it.

In anticipation of the founding of EUMETSAT, ESA launched the Meteosat Operational Programme (MOP) in March 1983.



EPS-SG – Metop-SG satellites

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Metop-SG A

Sounding and imagery

Simultaneous observations of clouds and vertical profiles of temperature and moisture in the atmosphere



Metop-SG B

Microwave imagery

Radar observations of ocean surface wind and soil moisture and passive microwave observations of precipitation and ice clouds

Two satellites will be working in tandem formation:

- Metop-SGA provides detailed information about the composition of the Earth's atmosphere and
- Metop-SGB provides information about the oceans, atmosphere and clouds.

Telemetry, tracking and control

Svalbard, Norway

Mission Data Acquisition

EUMETSAT Central Facilities

Darmstadt, Germany

Mission Control Centre

Product processing

Data archive

Data dissemination

EUMETSAT SAF Network

EUMETSAT member states

Satellite Application Facilities

Product processing chains

User software packages

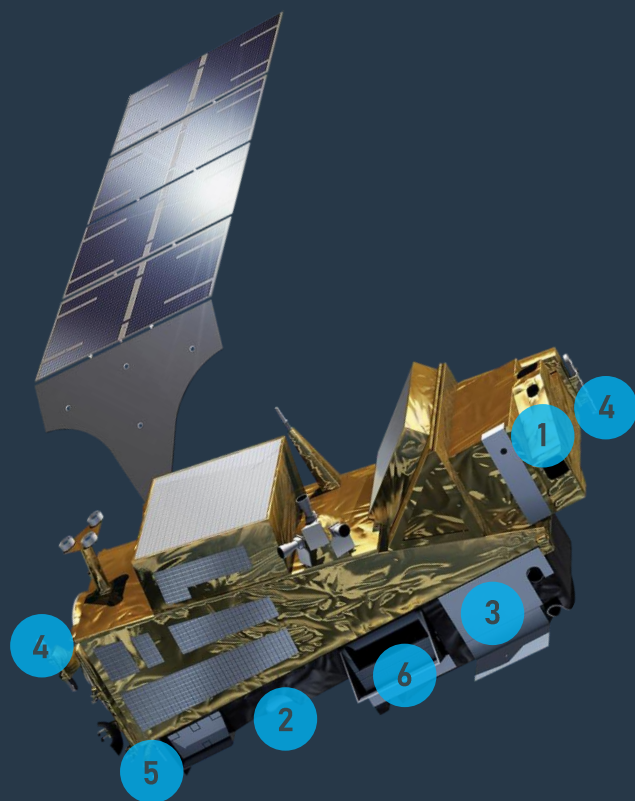
Backup Control Centre

Madrid, Spain

Telemetry, tracking and control

McMurdo, Antarctica

Mission Data Acquisition



1. Infrared Atmospheric Sounding Interferometer – New Generation (IASI-NG)
2. Microwave Sounder (MWS)
3. METImage (Visible-infrared imaging)
4. Radio Occultation (RO)
5. 3MI (Multi-viewing, -channel, -polarisation Imager)
6. Copernicus Sentinel-5 (UV/VIS/NIR/SWIR sounder)

Yellow highlighting: Use of radio frequencies governed by the ITU Radio Regulation (RR).



Metop-SGB microwave imaging mission

www.eumetsat.int



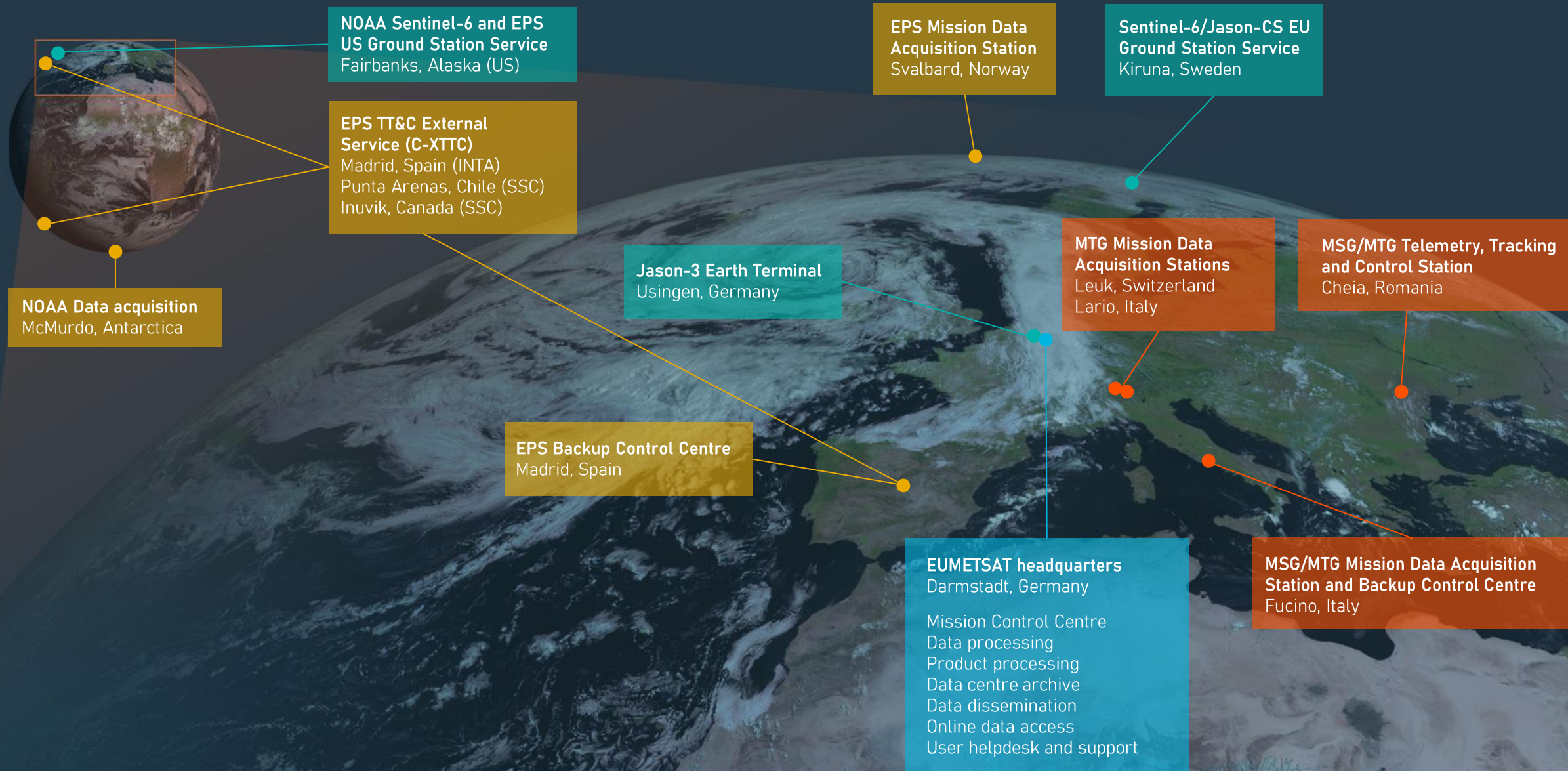
1. Scatterometer (SCA)
2. Radio Occultation (RO)
3. Microwave Imaging for Precipitation (MWI)
4. Ice Cloud Imager (ICI)
5. ARGOS-4 (Advanced data collection system)

Yellow highlighting: Use of radio frequencies governed by the ITU Radio Regulation (RR).



EUMETSAT ground systems across Europe...

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... control satellites and acquire data



Meteosat Second Generation

Fucino, Italy (top)
Cheia, Romania (bottom)

Meteosat Third Generation

Leuk, Switzerland
Lario and Fucino, Italy
Cheia, Romania



Metop and Metop-SG

Svalbard, Norway



Jason-3

Usingen, Germany



EUMETSAT mission control

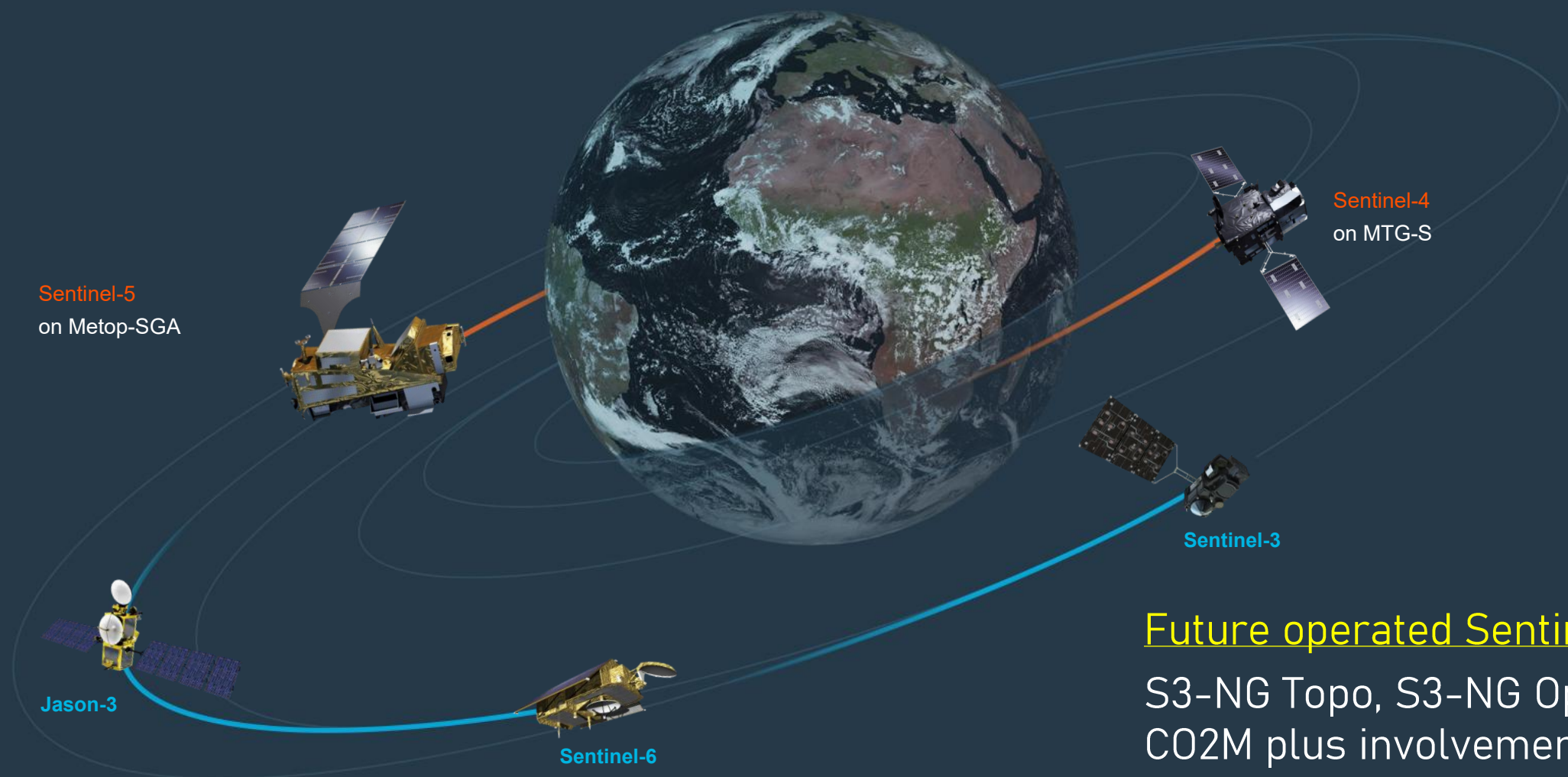


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EUMETSAT & third-party programmes supporting Copernicus

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Future operated Sentinels:

S3-NG Topo, S3-NG Opt, S6-NG, CO2M plus involvement in global products for CIMR and Cristal



The enhanced EUMETSAT response to the implementation of WIGOS 2040

- **EPS-Sterna**, a constellation of micro satellites for testing new space in an operational environment
- **EPS-Aeolus**, unique European technological expertise to improve numerical weather forecasts
- Ocean altimetry follow-on programme highly relevant for the detection of global sea level rise and of climate change





EPS-Sterna constellation planned for 2029

- Purpose:

- Providing data globally with unprecedented coverage and revisit time with large impact particularly over polar regions, complementing observations from METOP-SG, JPSS and FY-3.

- The satellite constellation architecture:

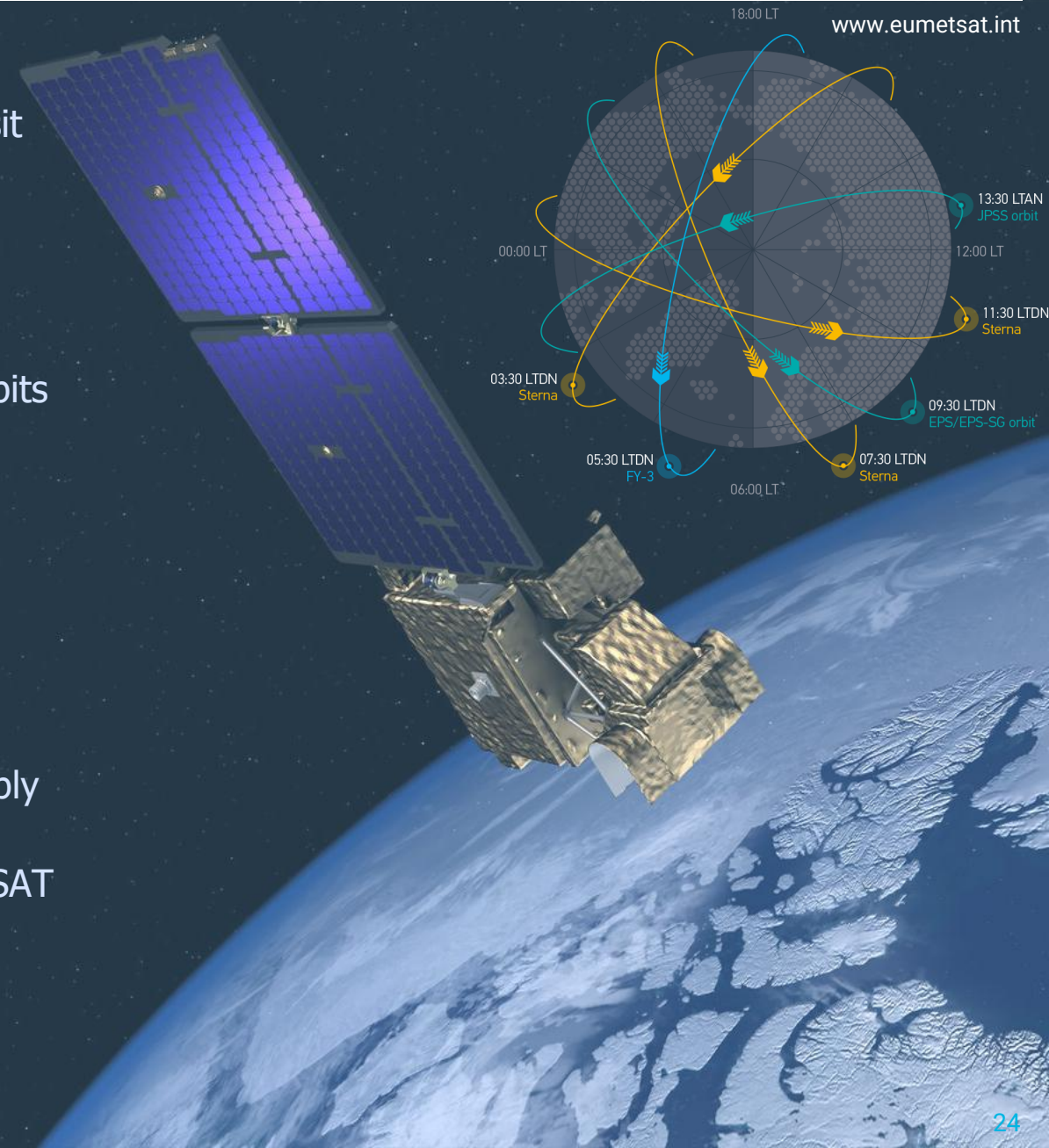
- Built upon the ESA prototype AWS-PFM satellite
- Constellation of 6 microwave sounding microsatellites on 3 orbits
- Complementary to the Metop-SG, JPSS and FY-3 orbits
- Total number of satellites: 20 satellites to ensure 14 years of operations

- Instrument:

- **Passive Microwave Radiometer (19 channels)**

- Ground stations:

- Global data (stored mission data): Svalbard station plus possibly a South Pole station;
- Regional and local data (direct broadcast): network of EUMETSAT stations and local users' stations;
- **Downlink to the users in the MetSat L-Band 1698-1710 MHz**





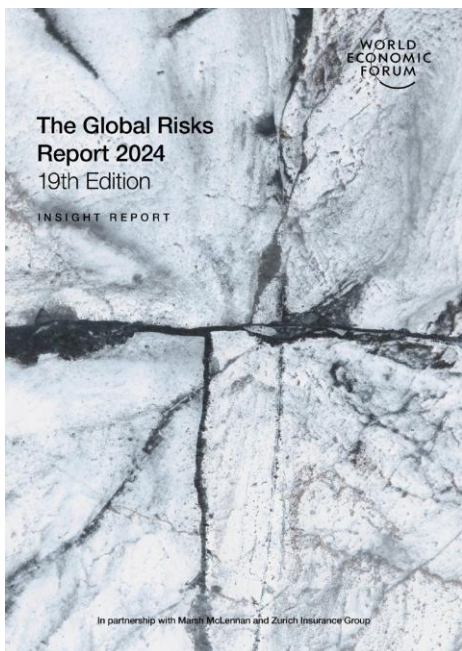
- Measures wind speed and direction using light reflected by particles carried by the wind
- Planned as an expansion of the EPS-Second Generation programme using the EUMETSAT/ESA cooperation model
- EUMETSAT will be responsible for the overall system development (ground stations, operations, data processing, dissemination, archiving, launch services and launch and early operations phase)
- ESA will be responsible for spacecraft and instrument development and procurement



What we do has value

Global risks perceptions highlight societal and environmental concerns

Respondents to the Global Risks Perception Survey rank failure to mitigate and failure to adapt to climate change as the number one and two long-term threats to the world and the risk with potentially the most severe impacts over the next decade.



Severity of risk over next two years



Risk categories



Economic



Environmental



Geopolitical



Societal



Technological

Severity of risk over next 10 years



Source: World Economic Forum Global Risks Report 2024

It is easy to take our daily weather forecasts for granted, but the social and economic benefits of accurate forecasts are huge – and this is largely thanks to satellites.



Over **95%** of the 40 million observations processed every day for weather forecasting are provided by satellites



Errors in one-day forecasts have been reduced by **64%** thanks to data from satellites

Satellite Data



Earlier and more accurate weather warnings



In the EU, socio-economic benefits of weather forecasting are estimated to be up to **€61 billion/year**

Around 1/3 of the European economy is **weather-sensitive**

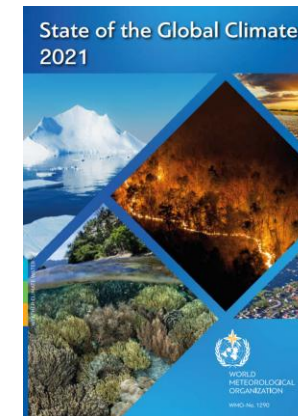


Agriculture
Energy
Transport
Search and Rescue
Infrastructure
Property
Tourism
Environmental Protection



Need for improved weather and climate observations (1/2)

Total losses due to weather- and climate-related events 1980-2020



“Loss and damages of more than US\$100 billion, as well as severe impacts on food security and humanitarian aspects due to high-impact weather and climate events have been reported [in 2021]”

WMO Secretary General, May 2022



Need for improved weather and climate observations (2/2)

Total losses due to weather and climate-related events
in sub-Saharan Africa 1970-2019



Africa, despite its low contribution to greenhouse gas emissions, remains the continent most vulnerable to the impact of climate change





Benefit to cost ratio of the EPS-SG programme

Most conservative forecast impact of 8% assumed, as for 21 years of observations of EPS/Metop

Protection of property
and infrastructure



Added value to the
European economy



Private use by
European citizens



TOTAL
€63bn
per year

Benefit to cost ratio of EPS-SG is approximately 20 to1
(2010 values, using discount rate of 4% and assuming GDP growth rate of 2%)



**Thank you very much
for your attention !!!**