

EUMETSAT Systems and Plans



Presented by **Dieter Klaes**
On behalf of all EUMETSAT Teams



The Organisation

EUMETSAT is an intergovernmental organisation with currently 30 Member States and 1 Cooperating State

The Mandate

EUMETSAT objective is to establish, maintain and exploit European systems of operational meteorological satellites, taking into account as far as possible the recommendations of the World Meteorological Organization.

A further objective is to contribute to the operational monitoring of the climate and the detection of global climatic changes.

The EUMETSAT Strategy "Challenge 2025" was adopted in June 2016



The Vision

Be the leading user-driven operational agency in Europe for earth observation satellite programmes that fulfil the objectives of its Convention, and a trusted global partner for those outside Europe who share these objectives.

Encourage the maximum use of EUMETSAT data and products.

Establish additional capabilities in partnership with the European Union and other satellite operators.



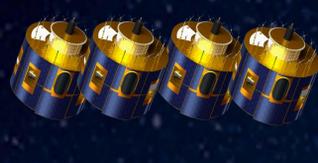
The International Context

EUMETSAT's meteorological satellites contribute to the World Meteorological Organisation's (WMO) Global Observation System in close co-operation between European, French and German Space agencies (ESA, CNES, DLR), with the U.S. partners NOAA and NASA and with the European Commission. This ensures the provision of global satellite data, data exchange and the coordinated development of new generations of meteorological and environmental satellites.



Current Systems Assure Continuous Services until the 2020 Time Frame

Meteosat Second Generation (MSG)

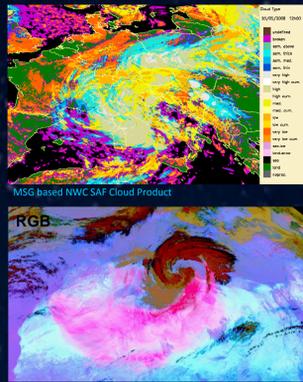


MSG: Operational, four satellites in orbit

The current prime operational satellite is Meteosat-10 (MSG-3) (at 0°), launched in July 2012. Meteosat-9 (MSG-2) provides 5 min. rapid-scan service over Europe and Northern Africa (at 9.5°E). MSG-4, now Meteosat-11, was launched 15 July 2015 was stored in orbit after commissioning (7 Dec. 2015) at 3.5° W. It is checked yearly and currently planned to be de-stored in 2018.

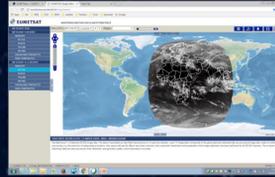
The second generation of geostationary Meteosat satellites (MSG) provides the geostationary service over Europe and Africa. MSG satellites provide since 2002 a stream of high-quality images from the 12 channel SEVIRI (Spinning Enhanced Visible and Infrared Imager) instrument every 15 minutes, to support improved forecasting and severe weather warning.

The Geostationary Earth Radiation Budget (GERB) Instrument provides information on the diurnal cycle of radiation budget components for the regions within the Meteosat field of view.



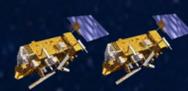
'DUST' product: Desert dust - 8.7/11, Thin ice cloud (Cirrus) - 8.7/11, Cirrus thickness - 8.7/11/12, Cloud altitude - 11/12

The last satellite of the first generation of the Meteosat series, Meteosat-7, ended its service in January 2017 and was deorbited in March 2017. Meteosat-8 (MSG-1) was moved to 41.5° E to contribute to the IODC mission.



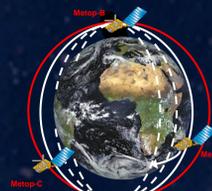
IODC Coverage with Meteosat-8 (MSG-1) at 41.5° E

EUMETSAT Polar System (EPS)



Metop: Operational, two satellites in orbit, one to be launched

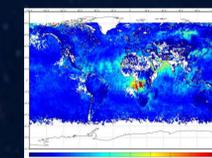
The EUMETSAT Polar System (EPS) provides detailed observations of atmospheric conditions like temperature and humidity profiles in global coverage from a polar, sun-synchronous orbit, with an equator crossing time of 9:30 Local Solar Time (desc. node). Its space component are the Metop satellites. Metop instruments provide also information on the atmospheric composition and chemistry, and ocean parameters. The Metop data are required for weather forecasting and in climate and environmental monitoring. Metop-A is in orbit since 19 October 2006 and will provide its services as long they bring benefits to the users. Metop-B was launched on the 17 September 2012 and is the prime satellite now. The orbits are phased 48.93 min. apart. Metop-C is being prepared for launch on the 20 September 2018 from Kourou.



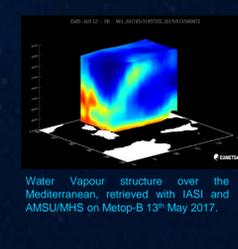
Metop-A's drifting orbit: August 2016, Metop-B and Metop-C will fly in the same orbital plane (30° LST ascending node). The phasing has to be a great configuration for commissioning. Final configuration can be decided at later stage. Metop-A is expected to have an extended lifetime until 2021/2022 timeframe. Until this time it is planned to operate three Metop Satellites.



Metop-B AVHRR sees Hurricane IRMA on the 8th September 2017.



Water Vapour structure over the Mediterranean, retrieved with IASI and AMSU/MHS on Metop-B 13th May 2017.



PMAP AOD from Metop-B: Product V.2.1 released Feb. 2017, provides AOD over ocean and land.

Meteosat Third Generation (MTG)



Jointly with ESA, EUMETSAT is currently developing the third generation of Meteosat satellites. The project is in Phase C/D.

This generation of Meteosat satellites are based on three-axis stabilized platforms. The operational configuration of MTG will be a system of two imaging satellites (MTG-I) and one sounding satellite (MTG-S) with the launch of the first MTG-I satellite planned in 2021 and the launch of the first MTG-S satellite planned in 2023.

Long Term Continuity: Future Systems planned for the Timeframe from 2020 – 2040+

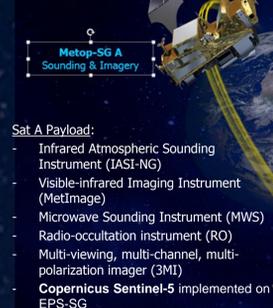
Imagery mission implemented by a two-satellite MTG-I system:

- Full disk imagery every 10 minutes in 16 spectral bands
- Fast imaging of European weather every 2.5 minutes
- new Lightning Imager (LI)

Hyper spectral Infrared (IRS) sounding mission:

- 3D mapping of water vapour, temperature, O₃ every hour
- Air quality monitoring and atmospheric chemistry in synergy with Copernicus Sentinel-4 Ultraviolet Visible NIR (UVN) Spectrometer

EPS-SG: Approved in 2015 under development. Metop-SG programme approved at ESA CMV12. Sentinel-5 on board Metop-SG A satellites.



- Sat A Payload:
- Infrared Atmospheric Sounding Instrument (IASI-NG)
 - Visible-infrared Imaging Instrument (MetImage)
 - Microwave Sounding Instrument (MWS)
 - Radio-occultation instrument (RO)
 - Multi-viewing, multi-channel, multi-polarization imager (3MI)
 - Copernicus Sentinel-5 implemented on EPS-SG

EUMETSAT Polar System Second Generation (EPS-SG)

- Sat B Payload:
- Scatterometer (SCAT)
 - Radio-occultation instrument (RO)
 - Microwave Imaging instrument (MWI)
 - Ice Cloud Imager (ICI)
 - Advanced Data Collection System (ADCS)

EUMETSAT is preparing the EPS follow on system, EPS-SG (EPS second generation), jointly with partners (ESA, NOAA, CNES, DLR). The planned launch date for the first satellite pair is June 2021/Dec. 2022. Planned missions will continue, extend and improve the current EPS services. A two satellite system is being developed. The project is currently in Phase-B. The programme was approved in summer 2015 by the EUMETSAT Council.



EPS-SG is part of the Joint Polar System with the US.

Jason-CS/Sentinel-6



Further in the future Jason-CS is planned to provide continuation services, in the 2020 to 2032 timeframe. The Jason-CS programme entered into force the 9 September 2015. Partners involved are EUMETSAT, ESA, EU, NOAA, NASA. Goal is to provide continuity of the reference orbit with 5 satellites (2020, 2026)

Jason-CS/Sentinel-6 is part of the Copernicus Programme.

Marine Services: Copernicus Jason-2/3-CS and Sentinel-3 (S-3)

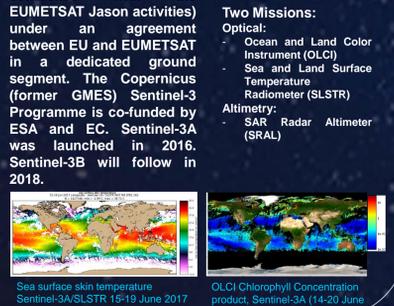


Sea level anomalies (variations with respect to a mean) in the North Atlantic Ocean on 19 January 2011. Red and blue 'patches' correspond to ocean eddies, especially in the turbulent flow of the Gulf Stream.

EUMETSAT is contributing to operational Ocean monitoring since more than 6 years since the launch of the Jason-2 satellite on the 20 June 2008. Jason-2 is exploited jointly with NOAA, NASA and CNES. Since 2016 in addition with Jason-3, EUMETSAT assures the operational real-time dissemination of products and services in Europe.

- Reference missions:
- TOPEX/Jason missions are the "reference" series for sea level climate studies.
 - Error budget and instrument stability of measurements suitable for sea level change monitoring.
 - Uninterrupted series of missions in same orbit for 25 years.
- Tandem missions:
- Successful "tandem" overlaps of 6 months with successor mission - 1 minute behind to build a unprecedented climate data record from satellites.

EUMETSAT has the responsibility of operations of the Copernicus Sentinel-3 marine missions (in coherence with the EUMETSAT Jason activities) under an agreement between EU and EUMETSAT in a dedicated ground segment. The Copernicus (former GMES) Sentinel-3 Programme is co-funded by ESA and EC. Sentinel-3A was launched in 2016. Sentinel-3B will follow in 2018.



Sea surface skin temperature Sentinel-3A/SLSTR 15-19 June 2017. OLCI Chlorophyll Concentration product, Sentinel-3A (14-20 June 2017).

Climate Services

EUMETSAT contributes with its satellite systems to monitoring changes in the climate system, like rising temperatures, melting ice and increasing sea level.

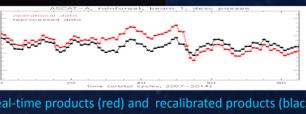
The EUMETSAT Satellite Application Facilities (SAF) are delivering products (Essential Climate Variables) for climate change monitoring, in particular the Climate Monitoring SAF.

EUMETSAT is part of the Global Satellite Inter Calibration System (GSICS) and of the SCOPE-CM project.

EUMETSAT mission data are reprocessed regularly, this includes the recalibration of historic Meteosat IR imagery and the re-calibration of ASCAT backscatter measurements.

The Climate Service Development Plan (CSDP), a rolling 4-5 year plan represents the EUMETSAT's commitment towards climate services. It benefits from product developments but also added needed developments for climate. It comprises:

- Generation of individual Climate Data Records (CDR and TCDR), engineering and coordination activities;
- Activities committed in EU projects such as ERA-CLIM2, joint activities with the SAF network, NOAA and other international partners, e.g., for SCOPE-CM
- Participation in Horizon 2020 funded projects (FIDUCEO and GAIA-CLIM)



ASCAT real-time products (red) and recalibrated products (black).

EUMETSAT Data Centre

- Archive dating back to 1981
- Over 2 Petabyte (PB) stored (2017)
- Established Long Term Data Preservation
- Capacity increased to 50 PB, scalable to 200 PB
- More than 150 meteorological satellite products
- Raw and reprocessed data, centrally and de-centrally produced
- Networked with Satellite Application Facilities (SAFs)
- Access online integrated into EO Portal registration

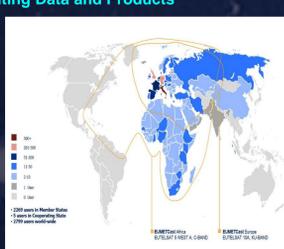
EUMETSAT distributed Application Ground Segment



Data processing, product generation and dissemination are done centrally in Darmstadt at EUMETSAT HQ, but also decentralised by a network of Satellite Application Facilities (SAF), centres of excellence in specific fields of meteorology and applications. Typical products include detailed ocean and land surface parameters and information on atmospheric composition, but also software packages to process EUMETSAT data. There are currently eight SAFs distributed over Europe. The CDOP-2 (Continuous Development and Operations) phase ended in spring 2017 and CDOP-3 started subsequently in 2017 after a preparation and evaluation period.

All EUMETSAT satellites transmit their measurement and telemetry data to receiving stations on the ground. From there they are relayed to the Control Centre in Darmstadt, Germany. Data are processed, archived in the EUMETSAT Data Centre, and in near real-time retransmitted to the User community, mainly via EUMETSAT's own EUMETCast dissemination system. EUMETCast is a multi-service dissemination system based on standard Digital Video Broadcast (DVB) technology. It uses commercial telecommunication geostationary satellites to multicast files (data and products) to a wide user community. EUMETCast forms the basis of EUMETSAT's contribution to the Integrated Global Data Dissemination Service (IGDDS), a component of the World Meteorological Organisation's Information Service (WIS). It also underpins EUMETSAT's contribution to GEONETCast, a global intergovernmental network of satellite-based Earth Observation data dissemination systems, and is connected in this framework to the Chinese CMACast system, thus enabling dissemination of EUMETSAT data in the Asia-Pacific region.

Distributing Data and Products

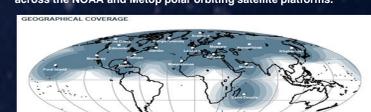


Open WMS Pilot Service 'EUMETView' <http://eumetview.eumetsat.int/> Planned to supersede the current "Real time imagery service" on EUMETSAT's webpage

EUMETSAT Advanced Retransmission Service (EARS)

The purpose of the regional service is to provide the European meteorological community with sounder, imager and scatterometer data, covering data-sparse areas, within 30 minutes of the instrument observations. The improved timeliness of regional data assists in earlier forecasting. A full list of EARS products can be found in the EUMETSAT Product Navigator.

EARS comprises of eight separate polar satellite instrument data services: EARS-ASCAT, EARS-ATOMS, EARS-AVHRR, EARS-IASI, EARS-NWC, EARS-ATMS, EARS-CHIS and EARS-WIRS. Each of the EARS services retransmits observations from an instrument, or an instrument group, and aims to provide a homogeneous service across the NOAA and Metop polar orbiting satellite platforms.



Third Party Data Services

To complement the satellite data and products generated by the EUMETSAT Application Ground Segment, EUMETSAT relays a range of third-party products from partner organisations. The majority are available via EUMETCast, some form part of the Meteosat Direct Dissemination Service. In addition to the Meteosat satellite data, EUMETSAT relays geostationary and polar satellite data from partner organisations like National Oceanic and Atmospheric Administration (NOAA), the China Meteorological Administration (CMA), the Indian Space Research Organisation (ISRO), the Japan Meteorological Agency (JMA), and the Russian ROSHYDROMET. These data are available via EUMETCast and through direct dissemination, via the Meteosat satellites. Within the scope of the Initial Joint Polar-Orbiting Operational Satellite System (JPOSS) EUMETSAT generates and disseminates polar orbiting data and products from the NOAA satellite series.