EUMETSAT Systems and Plans

Presented by *Dieter Klaes*

The Organisation

EUMETSAT is an intergovernmental organisation with currently 29 Member States and 2 Cooperating States

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 aims at further international/ intercontinental co-operation.

The Mission

- Deliver cost effective operational satellite data and products that satisfy the meteorological and climate data requirements of its Member States

- 24 hours a day, 365 days a year, over decades

- Encourage the maximum use of EUMETSAT data and products

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
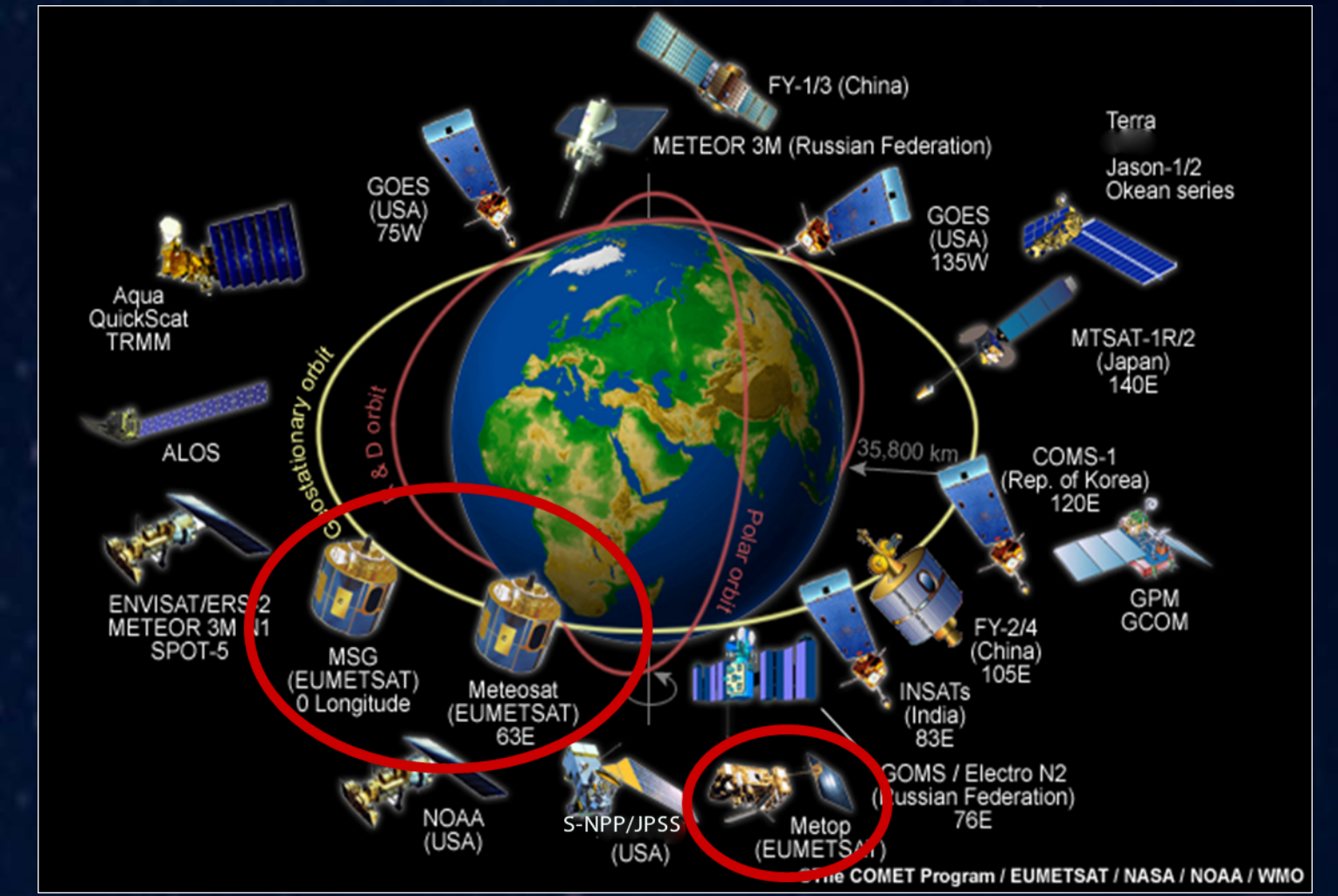
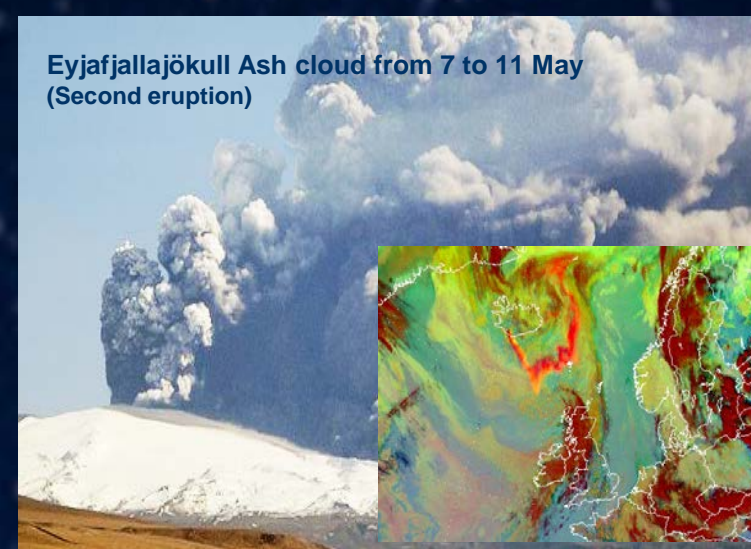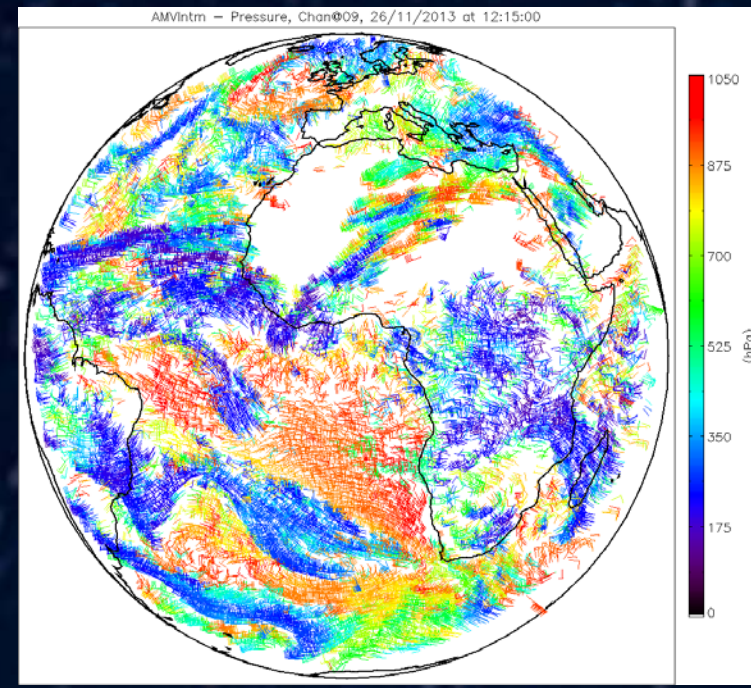### Meteosat Second Generation (MSG)
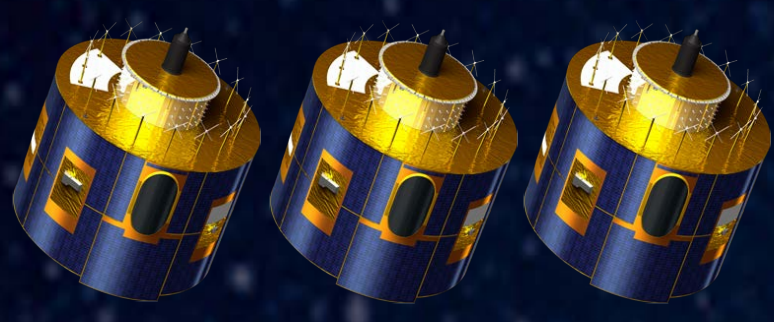
MSG: Operational, three satellites in orbit, one more to be launched

The current prime operational satellite is Meteosat-10 (MSG-3) (at 0°), launched in July 2012. Meteosat-8 (MSG-1) provides backup at 3.5 °E (Indian Ocean Data Coverage – TBD). Meteosat-9 (MSG-2) provides 5 min. rapid-scan service over Europe and Northern Africa (at 9.5°E). MSG-4 is planned to be launched in 2015 and stored in orbit until use at 3.5° W.

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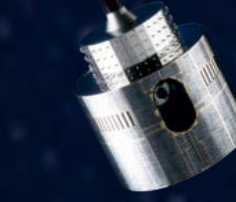
The Geostationary Earth Radiation Budget (GERB) Instrument provides Information on the diurnal cycle of radiation budget components for the regions within the Meteosat field of view.

Meteosat Transition Programme (MTP) (Meteosat First Generation)

MTP: Operational, one satellite still in orbit

The last satellite of the first generation of the Meteosat series, Meteosat-7, is still providing data services over the Indian Ocean (IODC = Indian Ocean Data Coverage) and supports a regional Tsunami warning system (Meteosat-7 at 57.5 °E). Meteosat-6 was re-orbited in May 2011.

The first generation Meteosat series provides images in three spectral channels every 30 minutes. The satellite was originally developed by ESA and first launched in 1977. Operations were taken over by EUMETSAT in 1995.

Eyjafjallajökull Ash cloud from 7 to 11 May (Second eruption)

### 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). The Metop satellites. Metop instruments provide also information on the chemical composition 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 in storage and planned for launch in 2018.

Metop-A and Metop-B fly in the same orbital plane (9:30 LST descending node)
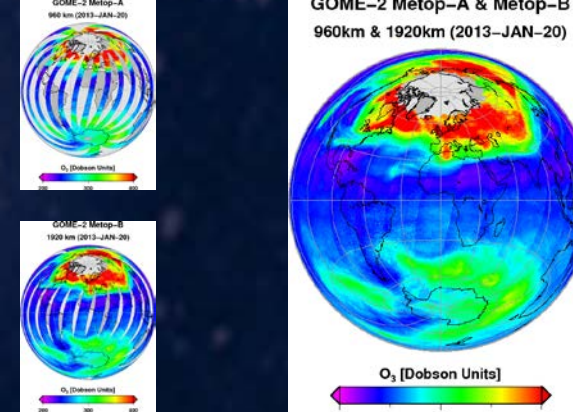
GOME-2 Tandem Operations thanks to Dual Metop Courtesy O3M SAF/DLR
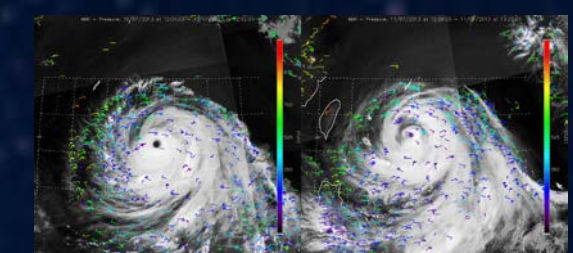
Dual Metop allow Global AMV, example Typhoon Soulik/Huaning over the Pacific, 10/11 July 2013 (R. Borde)

Jason-2

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

Long Term Continuity: Future Systems planned for the Timeframe from 2020 - 2040
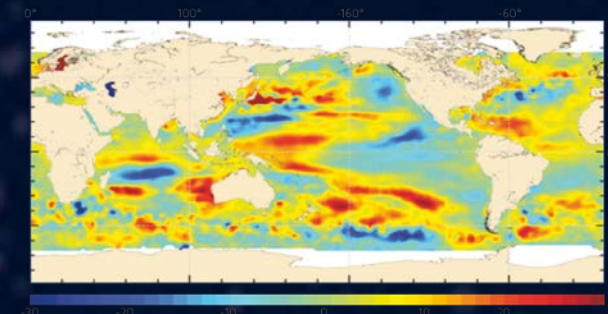
Meteosat Third Generation (MTG)

MTG: Approved, under development
Sentinel-4 on board MTG-I satellites

- 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 1 hour
  – Air quality monitoring and atmospheric chemistry in synergy with Copernicus Sentinel-4 Ultraviolet Visible

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 will be 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 2019 and the launch of the first MTG-S satellite planned in 2021.

EUMETSAT Polar System Second Generation (EPS-SG)
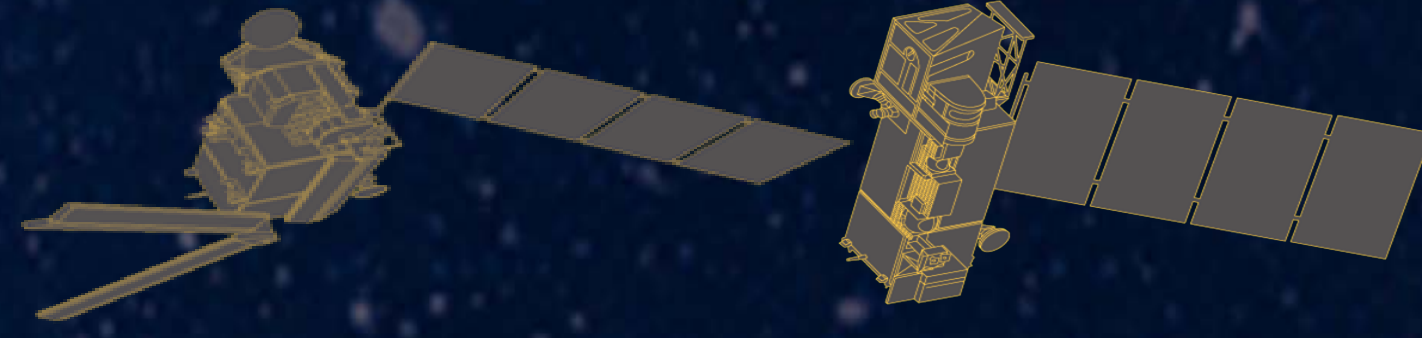
EPS-SG : to be approved in 2014
Metop-SG programme approved at ESA CMIN12
Sentinel-5 on board Metop-SG-A satellites

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**

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 need date for the first satellite is 2020. Planned missions will continue, extend and improve the current EPS services. A two satellite system is envisaged. The project is currently in Phase-B under a preparatory programme.
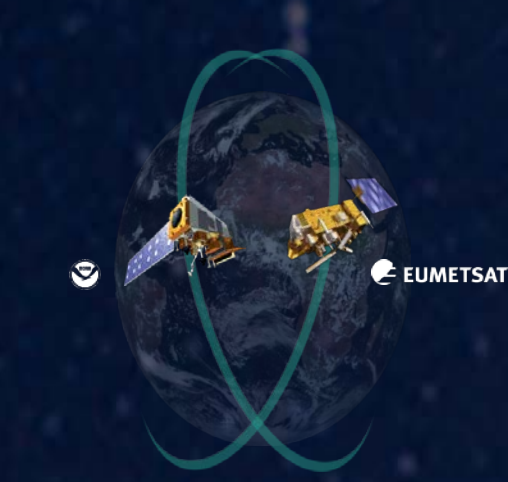
Jason-3

Jason-3: approved
Launch in March 2015

Jason-CS

Jason-CS/Sentinel-6: Proposed, to be approved in 2015

Continuity with Jason-3 and Jason-CS

EUMETSAT is preparing jointly with its partners the Jason-3 programme (approved in 2010) for a follow on mission of Jason-2 with a launch envisaged in March 2015. Partners NOAA/NASA/CNES.

Further in the future Jason-CS is planned to provide continuation services. A programme proposal is being prepared. Partners NOAA/NASA/CNES.

Marine Services: Copernicus Sentinel-3 (S3)

EUMETSAT has the responsibility of operations of the GMES Sentinel-3 marine missions (in coherence with the EUMETSAT Jason activities). The Copernicus (former GMES) Sentinel-3 Programme is co-funded by ESA and EC. A third party Sentinel-3 (S3) Programme was established and approved by EUM Council and subsequently an Implementing Arrangement for S3 was approved by EUM Council and ESA PBEO. Sentinel-3A is planned for launch in 2014.

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.

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

EUMETSAT mission data are reprocessed regularly.

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 adds needed developments for climate. It comprises

- Generation of individual Climate Data Records (FCDR 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;

CM SAF
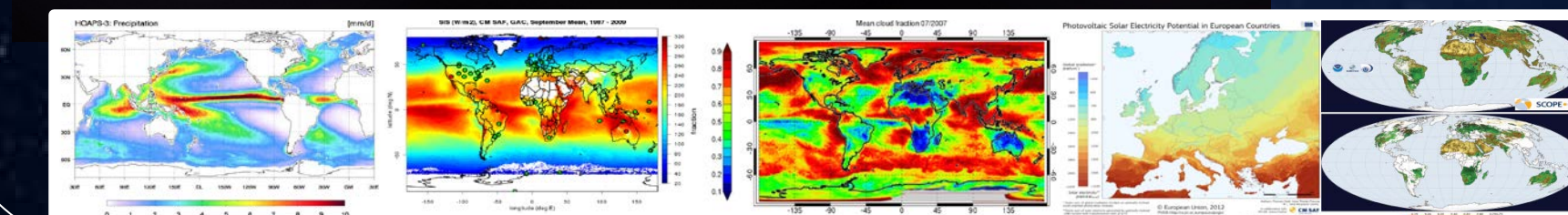
EUMETSAT Data Centre

- Archive dating back to 1981
- Over 1 Petabyte stored (end 2013)
- Established Long Term Data Preservation
- 1.4 Petabytes retrieved annually
- Raw and reprocessed data, centrally and de-centrally produced
- Networked with Satellite Application Facilities (SAFs)
- Access online via Product Navigator

---

EUMTSAT 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 certain 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. They started the CDOP-2 phase in March 2012.

EUMETCast: Distributing Data and Products

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 is the EUMETSAT contribution to GEONETCast.

EUMETCast South America EBS-4/C-BAND
EUMETCast Africa AB-3, C-BAND
EUMETCast Europe EB-9, KU-BAND
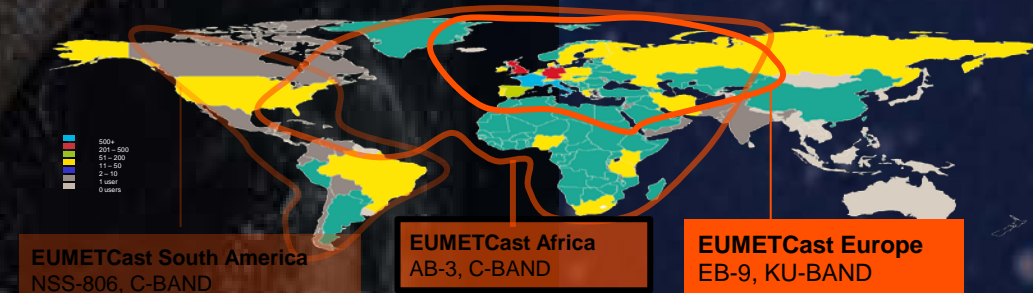
Third Party Data Services

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 LRIT Direct Dissemination Service.
In addition to the Meteosat satellite data, EUMETSAT relays geostationary satellite data from partner organisations like National Oceanic and Atmospheric Administration (NOAA), the China Meteorological Administration (CMA), the Indian Space Research Organisation (ISRO) and the Japan Meteorological Agency (JMA). 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 (IJPS) EUMETSAT generates and disseminates polar orbiting data and products from the NOAA satellite series.