

EUMETSAT Plans

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Abstract

This paper provides a summary on EUMETSAT mandatory and optional programmes. EUMETSAT is currently operating the Meteosat-5/6/7 and the first Meteosat Second Generation (MSG-1) which has been renamed as Meteosat-8. MSG-2/3/4 satellites are under production, with MSG-2 planned for launch in the second half of 2005. The MSG Programme has been developed in co-operation between EUMETSAT and ESA. In parallel, EUMETSAT is developing jointly with ESA the EUMETSAT Polar System (EPS).. The launch of the first Metop satellite is planned for April 2006.. The ATOVS Retransmission service continued its operational services and provides observations from ten stations. With Jason-2 EUMETSAT prepares its first optional programme, which will provide operational Ocean Surface Topography information services.

Introduction

The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) supports the World Weather Watch with a number of operational meteorological satellite programmes. These programmes include the European geostationary meteorological satellite system (Meteosat first generation under the Meteosat Transition Programme (MTP), a the Meteosat Second Generation (MSG)), and the EUMETSAT Polar System (EPS), as a contribution to the low Earth orbiting, Sun synchronous weather satellites system (Initial Joint Polar System (IJPS) with the Unites States). User and Data Services are provided together with these systems.

Programmatic Aspects

EUMETSAT Polar System (EPS)

The EUMETSAT Polar System (see Fig. 1) will complement the US provided system and provide services in the mid-morning orbit. Together with the US it will continue the present NOAA polar orbiting satellite system in the frame of the Initial Joint Polar System (IJPS). The EUMETSAT satellites of EPS are the Metop (METeorological OPERational) satellites, jointly developed with ESA (Figure 1). They will provide high-resolution sounding and high-resolution imagery in global coverage. The EPS programme activities have started in September 1998, while full approval to the programme was given in June 1999. The first two of the METOP satellites will be named Metop-A and Metop-B after successful launch. They will be flown in a Sun synchronous orbit with 9:30 a.m. equator crossing (descending node). They will provide data from April 2006 onwards. The third



Figure 1: EPS Space Segment (Metop Satellite).

Metop (Metop-C) will fly together with satellites of the converged military and civilian US-Systems (NPOESS). Metop-C is planned to be a recurrent copy of Metop-A and B. No HIRS/4 will be flown on METOP-C. The EPS programme is planned to cover 14 years of operation. For mission objectives and expected capabilities see Klaes et al. (2001).

Geostationary Systems

Meteosat-7 assured since 1997 the meteorological geostationary satellite data coverage under the Meteosat Transition Programme MTP). Meteosat-7 has the same capabilities as its predecessors. Together with the first MSG satellite Meteosat-8, Meteosat-7 is operated as part of a redundant two-satellite system. The first spacecraft of the MSG Programme was successfully launched in August 2002 and started its operational service in January 2004. It has significant improvements in the observation capability and a nominal lifetime of seven years. It embarks in addition to the main observation mission, a climatology experimental mission performed via Geostationary Earth Radiation Budget Instrument, a Search and Rescue mission and a mission communication payload. Three further spacecraft, MSG-2, MSG-3 and MSG-4 are foreseen to be launched in the second half of 2005 (23 August 2005 is the MSG-2 launch date as currently defined), and in the 2008/9 and 2010/11 timeframe.

The Meteosat-5, -6, -7 and -8 satellites represent the current operational geostationary satellites. Meteosat-5 is supporting the INDOEX experiment and is currently situated at 63°E over the Indian Ocean. The Indian Ocean Coverage with Meteosat-5 will continue until end 2006, then with Meteosat-7 (after successful commissioning of MSG-2/Meteosat-9) through the end of 2008. Meteosat-6 provides the rapid scan service, operational since 2001. Both Meteosat-7 and Meteosat-8 are kept fully operational ensuring the smooth transition from the first to the second Meteosat generation until the entry into operations of MSG-2..

Optional Programmes

The Jason-2 altimetry programme is the first EUMETSAT optional programme, supporting operational climate monitoring. EUMETSAT will contribute to the operations of the overall system and to the generation of the data stream, using a European Earth Terminal and a real time processing chain.

The programme is EUMETSAT's contribution to a joint undertaking with four agencies: In addition to EUMETSAT, the French Centre National d'Etudes Spatiales (CNES), the US National Oceanic and Atmospheric Administration (NOAA) and the US National Aeronautics and Space Administration (NASA). This forms the Ocean Surface Topography Mission (OSTM). It is an important element in the overall altimetry data system and will bring high precision altimetry to a full operational status.

SPACECRAFT AND INSTRUMENTS

EUMETSAT Polar System

The Metop satellites of EPS will be launched into a Sun synchronous, near polar orbit with an equator crossing time of 09:30 AM (descending node), i.e. the so called morning orbit. To achieve the mission objectives in operational meteorology and climate monitoring an appropriate payload was embarked on Metop, with a number of sounding instruments. The HIRS/4 (High Resolution Infrared Radiation Sounder) instrument, the AMSU-A (Advanced Microwave Sounding Unit - A) and the MHS



Figure 2. EPS services.

(Microwave Humidity Sounder) instrument as successor of AMSU-B (MHS was developed by EUMETSAT), provide the continuity to the current polar sounding capabilities onboard the NOAA-15, NOAA-16 and NOAA-17 spacecraft. New technology and hyperspectral infrared sounding capability is provided by the IASI (Infrared Atmospheric Sounding Interferometer) instrument, improving soundings both in accuracy and also vertical and horizontal resolution. The sounding payload is complemented by the AVHRR/3 (Advanced Very High-Resolution Radiometer) multi-spectral imager, which will provide visible and infrared imagery at high horizontal resolution. EPS products comprise centrally processed level 1 products from all instruments and level 2 sounding products from ATOVS and IASI (from the EPS Core Ground Segment (CGS)) and a large number of level 2 and higher level products from the distributed Satellite Application Facilities (see Figure 2 for EPS services.).

Instruments, successfully flown on research missions, will be flown in operational service. The Global Ozone Monitoring Experiment (GOME-2) for ozone profiling and trace gas retrieval is in the heritage

of the GOME-1 instrument on ESA's ERS-2 and will provide additional sounding capabilities. An Advanced Scatterometer (ASCAT) will provide improved capability to retrieve wind vectors at the ocean surface, continuing the successful SCAT instrument on ESA's ERS-1 and ERS-2 satellites.

Further sounding capabilities will be provided by the GRAS (GPS Radio-Occultation Atmospheric Sounder), which will make use of the information on the atmosphere and ionosphere contained in the GPS navigation satellite signals through the radio-occultation technique. This will be the first operational radio-occultation mission. A full system will be installed, including a GRAS Ground Support Network (GSN) to support the clock error corrections required for the GPS and Metop clocks as well as a precise orbit determination service.

Geostationary Satellites

Meteosat Transition Programme

The first generation Meteosat and the equivalent Meteosat Transition Programme Satellites (Meteosat-7) have as payload a three-channel imager with broad-band channels in the visible, infrared, and water-vapour regions of the spectrum. The spacecraft is spin stabilised with 100 rotations per minute. The imager yields a full disk image every 30 minutes. The sampling distance at the sub satellite point is 2.5 km for the visible, 5 km for the infrared and water vapour channels. There are 5000 x 5000 pixels of visible and 2500 x 2500 pixels of infrared and water vapour channel data per full disk image. The products include satellite-tracked winds, cloud products, upper level tropospheric humidity, and others.



Figure 3. IODC service as first generation Meteosat service.

Meteosat Second Generation

The Meteosat Second Generation spacecraft is also a spin-stabilised satellite. Its payload comprises

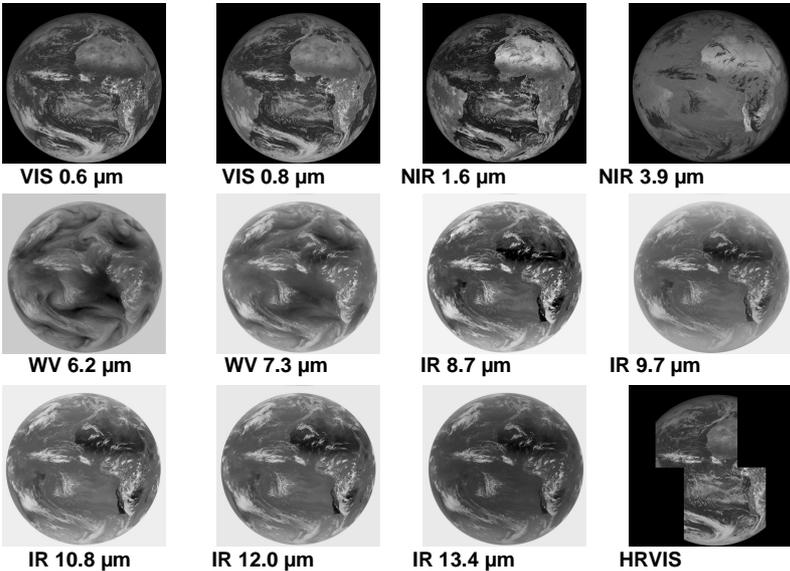


Figure 4: MSG capabilities: Example images from 12 SEVIRI Channels.

The Spinning Enhanced Visible and Infrared Imager - (SEVIRI) with 12 different spectral channels



Figure 5: Meteosat-8 image example: Sahara dust.

(see Figure 4) in the visible and infrared region of the spectrum (see example image in Figure 5) and the GERB (Geostationary Earth Radiation Budget) instrument intended to provide measurements of the Earth Radiation Budget from geostationary orbit. As new products stability parameters will be derived from pseudo-sounding (e.g. lifted index). Humidity fields are derived in the upper and mid-troposphere and total ozone fields are planned to be estimated. The sampling of the image data at the sub-satellite point are 3 km with exception of the High Resolution Visible channel (HRV), where the resolution is planned to be 1 km. The full disk image is composed of 3750 x 3750 pixels (except for HRV). One full disk image is provided every 15 minutes, but alternative repeat cycles up to 3 minutes are also possible. In HRV mode the scan area can be selected among predetermined rectangular blocks. Products are generated in the ground segment facilities at EUMETSAT's HQ and in the distributed part of the EUMETSAT application ground segment, the Satellite Application Facilities (SAF's). For details see Holmlund and König, 2004.

ATOVS RETRANSMISSION SERVICE

EUMETSAT provides a fast delivery service of Advanced TOVS data, based on HRPT stations for the North Atlantic and European Area. The service was installed based on an initiative of the members of the HIRLAM Group (Denmark, Finland, Ireland, The Netherlands, Norway, Spain, Sweden and Iceland) in November 2000. The service provides ATOVS level 1a and level 1c data with a timeliness of 30 minutes to cover the needs of EUMETSAT Member States regional and local

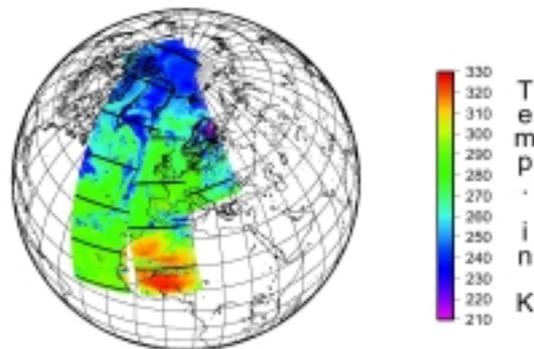


Figure 6: EARS product example: Three passes of HIRS data.

numerical weather prediction requirements for sounder data. Today the data of ten HRPT stations are distributed (see Fig. 6 with an example of acquired HIRS data). The operational phase will be continued and extended for use with NOAA-N and Metop. ASCAT level 1b dissemination and later AVHRR will be added to the service. More details can be found on EUMETSAT's web site (see <http://www.eumetsat.int>, on the EARS (EUMETSAT ATOVS Retransmission Service) home page.)

Outlook

EUMETSAT and ESA have in 2001 jointly started the process to define the follow on service for the geostationary satellite service, the Meteosat Third Generation (MTG), aimed for 2015. Several user and expert workshops have been conducted, and baseline concepts are being explored. Missions investigated are a) Multispectral imaging (SEVIRI continuity), b) Infrared high spectral resolution sounding, c) UV sounding, d) Lightning imager.

The requirements analyses for the post-EPS era have also been started. They aim for a need date in 2019 for an EPS follow-on service.

Conclusions

The above-presented systems represent the EUMETSAT contribution to the global system of satellite observation within the World Weather Watch and the Global Observation System. Considerably improved sounding capabilities are expected to provide a major contribution towards the improvement of operational meteorological services, in particular numerical weather prediction. An important contribution to climate monitoring will arise from the coming programmes and satellites. Further contributions from EUMETSAT include optional programmes like the Jason-2 data processing and distribution.

References

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