

EUMETSAT Plans

K. Dieter Klaes
EUMETSAT
Am Kavalleriesand 31
D-64295 Darmstadt
Germany

Abstract

This paper provides a summary on EUMETSAT current and planned programmes. EUMETSAT is currently developing, jointly with ESA the EUMETSAT Polar System (EPS) and commissioning the Meteosat Second Generation (MSG). The launch of the first Metop satellite is planned for 2005. MSG-1 has been successfully launched in 2002 and will start to provide validated observations from the Earth/Atmosphere system early 2004 (MSG-1). The ATOVS Retransmission service became operational and provides observations from six stations. With Jason-2 EUMETSAT goes towards its first optional programme, which will provide operational altimetry services.

Introduction

The European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), contributes to the World Weather Watch system with a number of operational meteorological satellite programmes. These programmes include the continuation and improvement of the current European geostationary meteorological satellite system and also the EUMETSAT Polar System (EPS), as a contribution to the low earth orbiting, quasi sun synchronous weather satellites system. 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 together with the latter continue the present NOAA polar orbiting satellite system in the frame of the Initial Joint

Polar System (IJPS) (Figure 1). The future EUMETSAT satellites of this new polar system are the METOP (METEorological OPERational Satellite) satellites, jointly developed with ESA. They will provide high-resolution sounding and also 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 operated in the frame of the Initial Joint Polar System (IJPS) together with the present NOAA system of the United States. These METOP-1 and METOP-2 spacecraft are foreseen for a sun synchronous orbit in the 9:30 AM equator crossing (descending node). They will provide polar data from 2005 onwards. With the third

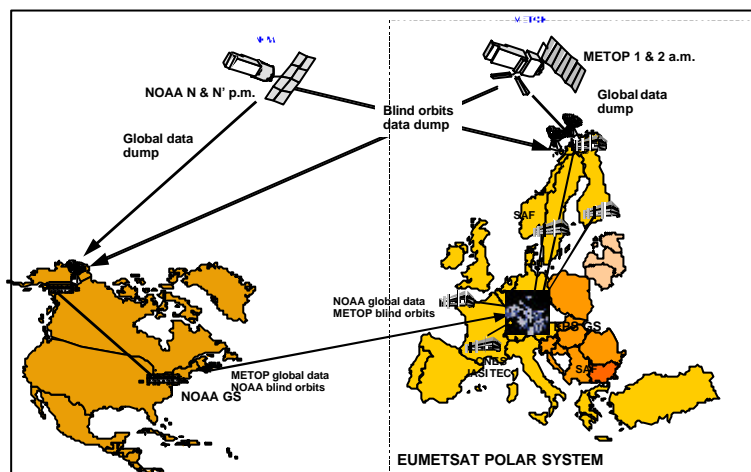


Figure 1: EPS as part of the Initial Joint Polar System.

spacecraft the converged military and civilian US-Systems NPOESS will form together with METOP-3 the Joint Polar System (JPS). METOP-3 is planned to be a recurrent copy of METOP-1 and 2. No HIRS/4 will be flown on METOP-3. Payload options for the imager and the microwave sounding instruments are VIRI-M and ATMS in case AVHRR and AMSU were not available and are currently being investigated. 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 continuity of meteorological geostationary satellite data coverage until the end of the commissioning phase of the new generation of the Meteosat Second Generation (MSG) Spacecraft. Meteosat-7 has the same capabilities as its predecessors. Together with MOP and then after 2003, together with MSG, MTP will be operated as part of a redundant two satellite system. The first spacecraft of the MSG was successfully launched in August 2002 and will become

operational in early 2004. It has an improved observation capability and a lifetime of seven years. Two further spacecraft, MSG-2 and MSG-3 are foreseen, and a fourth MSG is in the approval process.

The Meteosat—5, -6 and -7 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 is authorised to be continued until end 2005. Meteosat-6 is the hot stand-by satellite and provides the rapid scan service, which is operational since 2001. Meteosat-7 is in the nominal operational position at 0° longitude providing half-hourly full disk images.

Optional Programmes

The Optional Jason-2 programme on altimetry entered into force on 27 June 2003, after sufficient member states have subscribed to the programme.

The Jason-2 altimetry programme is the first EUMETSAT optional programme to implement EUMETSAT's amended Convention from November 2000. This Convention expands the mandate given to EUMETSAT by its Member States in operational climate monitoring and the detection of global climatic changes. 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.

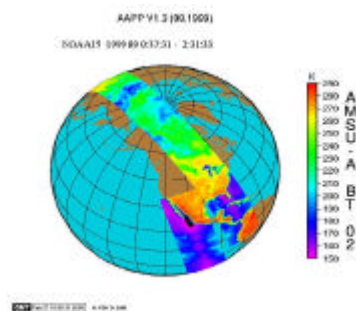
The programme is EUMETSAT's contribution to a joint undertaking with the French Centre National d'Etudes Spatiales (CNES), the US National Oceanic and Atmospheric Administration (NOAA) and the US National Aeronautics and Space Administration (NASA), known as the Ocean Surface Topography Mission (OSTM). It is an important element in the overall altimetry data system and will bring high precision altimetry to a full operational status, as a result of a balanced co-operation between Europe and the USA.

SPACECRAFT AND INSTRUMENTS

EUMETSAT Polar System

The METOP satellites of the EUMETSAT Polar System (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 in 2005. The main mission objectives for the system are Operational Meteorology and Climate Monitoring. In addition the Search and Rescue Instruments and also the Space Environment Monitor are embarked. To achieve these objectives the appropriate payload will be 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

EPS provides GLOBAL products



Composite of
14 level products
of one day
from HIRS

Global Products are dump-based

EPS provides local AHRPT/LRPT service

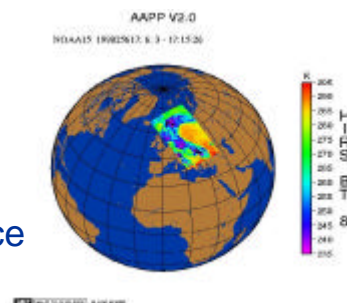


Figure 2. EPS services: Examples of global and local service.

(Microwave Humidity Sounder) instrument as successor instrument of AMSU-B (MHS was developed by EUMETSAT), will provide the continuity to the current polar sounding capabilities onboard the NOAA-15, NOAA-16 and NOAA-17 spacecraft. Highly improved sounding capability will be provided by the IASI (Infrared Atmospheric Sounding Interferometer) instrument, 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 global 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 and a large number of level 2 and higher products from the distributed Satellite Application Facilities (see Figure 2 for examples).

The GOME-2 instrument for Ozone profiling and trace gas retrieval will provide additional sounding capabilities. Further sounding capabilities will be provided by the GRAS (GPS Radio-Occultation Atmospheric Sounder) system, 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.

An Advanced Scatterometer (ASCAT) will provide improved capability to retrieve wind vectors at the ocean surface.

Geostationary Satellites

Meteosat Transition Programme

The Meteosat Operational System and the equivalent Meteosat Transition Programme Satellite (Meteosat-7) have as payload a three-channel imager with broad band channels in the visible, infrared and water vapour region 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 pixel of visible and 2500 x 2500 pixel 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.

Meteosat Second Generation

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

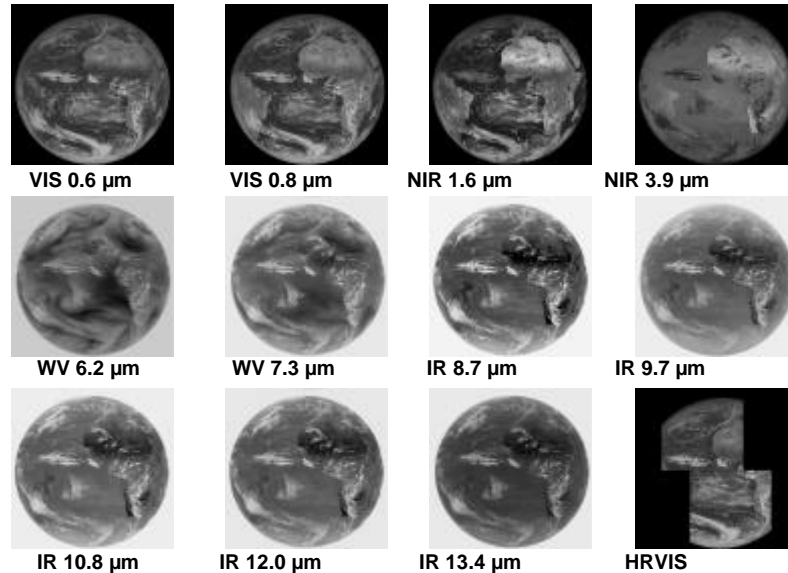


Figure 3: MSG capabilities: Example images from 12 SEVIRI Channels.

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

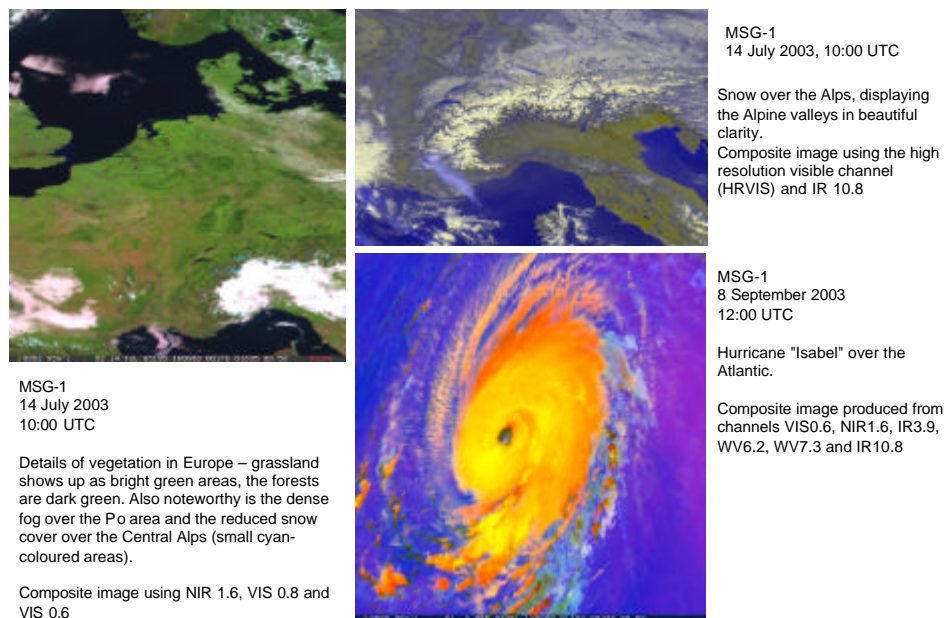


Figure 4: MSG-1 Example Images

Figure 3) in the visible and infrared region of the spectrum (see example images in Figure 4) and the GERB (Geostationary Earth Radiation Budget) instrument, intended to make accurate measurements of the Earth Radiation Budget from geostationary orbit. Stability parameters can be derived from pseudo-sounding (e.g. lifted index). Humidity fields can be derived in the upper and mid-troposphere. Total ozone fields can 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). It is planned to provide one full disk image 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 central facility and in the distributed part of the EUMETSAT application ground segment, the SAF. For details see Schmetz et al., 2002.

ATOVS RETRANSMISSION SERVICE

The members of the HIRLAM Group (Denmark, Finland, Ireland, The Netherlands, Norway, Spain, Sweden and Iceland) approached EUMETSAT in November 2000 to assess the feasibility of a fast delivery service of HRPT based ATOVS data for the Northern Atlantic and European Area. The

Coverage by end of 2003 : Gander, Bedford, Wallops, Gilmore Creek

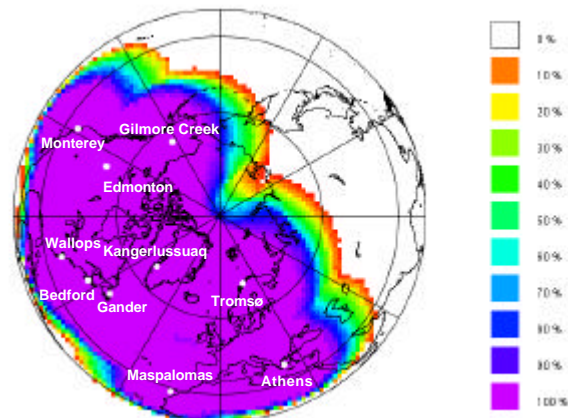


Figure 5: EARS data coverage.

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 Numerical Weather Prediction requirements for sounder data. The service within the pilot project started in October 2002. By end of 2003 the data of ten HRPT stations are distributed (see Fig. 5). The initial operational phase is approved until end 2004.

Details can be seen on EUMETSAT's web page (see <http://www.eumetsat.de>, on the EARS (EUMETSAT ATOVS Retransmission Service) home page.)

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

- Klaes, D., J. Schmetz, M.Cohen, Y. Buhler, J. Figa, J.-P. Luntama, R. Munro, P. Schlüssel, J. Kerkmann and A. Ratier, 2001: The EUMETSAT Polar System within the Initial Joint Polar System: Mission objectives, expected capabilities and products. 1st Post EPS User Consultation Workshop, AEG Reference Documentation, 48 pp.
- Schmetz, J., P. Pili, S.Tjemkes, D. Just, J.Kerkmann, S. Rota and A.Ratier, 2002: An Introduction to Meteosat Second Generation (MSG). Bull. Amer. Meteorol. Soc., 83, Number 7, 977 – 992.