AN INTRODUCTION TO THE EUMETSAT POLAR SYSTEM

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The first operational European polar meteorological satellite system provides greatly enhanced capabilities, in particular for hyperspectral infrared atmospheric sounding and atmospheric trace gas monitoring.

The EPS (see the appendix) with its Metop satellites, will be Europe’s first series of polar-orbiting satellites for operational meteorology. The EPS space segment consists of three satellites providing operational services until 2020. The meteorological community has been benefiting for more than two decades from the services of the NOAA polar-orbiting satellites from the TIROS-N and advanced TIROS-N (ATN) series, the first of which was launched in 1978 (Schwalb 1978, 1982; Rao et al. 1990). These satellites provide important contributions to the Global Observing System, based on a suite of imaging and sounding instruments, direct broadcasting, and data collection capabilities. Their sounding capabilities, enhanced in 1998 by the inclusion of the AMSU all-weather microwave sounders, provide important information to NWP models and to Nowcasting, especially

Artist view of Metop flying over a coastal area. Flight direction is from left to right (Source: ESA).
at high geographical latitudes. To these NOAA satellite series, Europe has already contributed with the following instruments: the SSU (Pick 1978) and also the AMSU-B instrument (Saunders 1993).

The EPS is the European contribution to a joint European–U.S. operational polar satellite system, the Initial Joint Polar System (IIPS; Klaes et al. 2001; Cohen et al. 2001; Cohen et al. 2006). EPS serves the midmorning (a.m.) orbit, whereas the American contribution continues to cover the afternoon (p.m.) orbit. The satellites have been developed in cooperation by EUMETSAT, and the ESA (Edwards and Pawlak 2000; Edwards et al. 2006), and the CNES.

The first Metop satellite was successfully launched on 19 October 2006 from the Baikonour Cosmodrome with a Sojuz/Fregat launcher. The Metop satellites fly in a sun-synchronous midmorning orbit (descending node at 0930 LST) at an altitude between 796 and 844 km and an inclination of about 98.70°. Metop satellites are composed of the PLM and the SVM with the solar array, and weigh about 4200 kg. They are about 6 m long and 3.4 m across (17 m in orbit with the deployed solar array).

The main user requirements ask for products that allow assimilation into Numerical Weather Prediction models to obtain information on temperature and humidity. In addition, imagery supports sounding by cloud detection and analysis, estimates of sea surface temperature, and radiation budget components. These products also support the monitoring of climate and atmospheric chemistry. The main users of EPS–Metop are hence national weather services and Numerical Weather Prediction centers as well as the climate monitoring and chemistry community. Key products of EPS/Metop from the central core ground segment are

- global level 1 products from all meteorological instruments:

  - atmospheric sounding radiances, IR and microwave;
  - global imagery VIS, NIR, and IR;
  - global UV/VIS/NIR radiances;
  - radar backscatter triplets;
  - global bending angle products from radio occultations;

- global level 2 sounding products:

  - temperature and humidity profiles from IASI and ATOVS,
  - ozone profile information,
  - trace gas total columns.

From the eight SAFs, which are the decentralized component of the ground segment, a wealth of level 2 and higher geophysical products will be provided (see the EUMETSAT Web site at www.eumetsat.int/Home/Main/What_We_Do/SAFs/index.htm?l=en).

In accordance with the EUMETSAT convention, the major mission objectives that EPS aims to fulfill are operational meteorology and climate monitoring. With its manifold sensors and enhanced capabilities in sounding, not only in terms of the atmospheric state, that is, temperature and humidity, but also identifying constituents and chemistry components, the system provides a contribution to global Earth system monitoring. Long-term monitoring is assured through the mission duration of at least 14 years.

This paper introduces the EPS System and the Metop satellites with a focus on their (enhanced) capabilities, products, and services. The next section gives an overview on the mission payload, and section “EPS products” provides an overview of the EPS products. The section “EPS data processing and dissemination” then discusses data processing and dissemination from EPS. A list of acronyms is appended and technical details of the instruments are summarized online (www.eumetsat.int).

MISSION PAYLOAD. The scientific payload embarked on Metop aims to achieve the objectives outlined above (Fig. 1). With eight instruments related to atmospheric science, Metop provides both continuity to previous operational measurements and also progress through data from novel instruments. AVHRR, and the ATOVS package (Rao et al. 1990; NOAA NESDIS 2000), composed of HIRS/4, AMSU-A, and MHS, provide the continuity to the current NOAA POES (NOAA–KLM or NOAA-15, -16, and -17) system (where ATOVS is composed of HIRS-3, AMSU-A, and AMSU-B) and are common to the payload on the afternoon satellites (NOAA-18 and NOAA-N’).
MHS is a EUMETSAT development and replaced the AMSU-B instrument in the ATOVS suite, whilst NOAA provides the AMSU-A, HIRS/4, and AVHRR instruments. MHS is already in orbit since the launch of NOAA-18 (20 May 2005). The IASI instrument is novel technology, developed by CNES, and introduces hyperspectral resolution sounding capabilities in the infrared (Hébert et al. 2004).

Within the Metop Programme, some payload components have been developed from the heritage of proven research missions on the ERS satellites. One of these components is GOME-2 (Callies et al. 2000), and another one is the ASCAT (Gelsthorpe et al. 2000), which draws on the ERS AMI heritage.

The measurement principle of the radio occultation payload GRAS (Loiselet et al. 2000), has been successfully demonstrated on several research missions (see, e.g., Melbourne et al. 1994; Kursinski et al. 1997; Zou et al. 2004; Healy and Thépaut 2006). The embarkation of GRAS on Metop required the development of a whole system, which includes precise orbit determination and support measurements on the ground, requiring a GSN.

The individual payload elements and their mission objectives are discussed in the following sections. Product guides and information on the instruments, processors, and algorithms are available online on the EUMETSAT Web site (www.eumetsat.int/Home/Main/Publications/Technical_and_Scientific_Documentation/Technical_Notes/SP_1126189367518?1=en).

Infrared Atmospheric Sounding Interferometer. IASI provides high-accuracy hyperspectral resolution atmospheric soundings of temperature, humidity, ozone, and trace gases. IASI is the most innovative instrument on Metop. The underlying measurement principle is that of a Michelson Interferometer. IASI has the equivalent of 8461 spectral channels, aligned in three bands between 3.62 μm (corresponding to 2760 cm⁻¹), where solar backscatter begins to contribute, and 15.5 μm (645 cm⁻¹), covering the peak of the thermal infrared and particularly the intense CO₂ ν₂ band with Q branch at around 666.6 cm⁻¹. The line spacing in the 15- and 4.3-μm CO₂ absorption bands drives the spectral resolution requirements. This spacing is equal to 1.5 cm⁻¹ in most of the bands and to 0.75 cm⁻¹ in some parts. The need to resolve CO₂ absorption bands requires a spectral resolution of 0.5 cm⁻¹ after apodisation. Consequently, the instrument was specified with a maximum OPD of 2 cm, which is equivalent to a spectral sampling of 0.25 cm⁻¹. The self-apodization leads to a resolution of 0.3 to 0.4 cm⁻¹. In the level 1c processing step the spectra are apodized to a spectral resolution of 0.5 cm⁻¹. Figure 2 shows part of an IASI spectrum compared to some HIRS filter functions in order to demonstrate the gain in information.

Included in the sounding instrument is an IIS. It is used to provide the Earth location of the IASI pixels at 1-km accuracy through coregistration with the AVHRR pixels during the level 1 processing. The mapped AVHRR information will then be used to classify inhomogeneous IASI scenes (Phillips and
Schlüssel (2005) and to determine the cloud coverage of an IASI pixel. The IIS consists of a broadband radiometer measuring between 10 and 12 μm with high spatial resolution to obtain detailed analysis of cloud properties inside the IASI sounder pixels. The IIS IFOV is defined by a squared area of 59.63 m rad \times 59.63 m rad, covering 64 × 64 pixels.

**The ATOVS suite.** On the NOAA-15, -16, and -17 satellites, ATOVS comprised AMSU-A, AMSU-B, and HIRS-3, three passive sounding instruments with a total of 39 channels in the infrared and microwave spectral regions and one channel in the visible part of the spectrum. On Metop-A, Metop-B, and Metop-C, and the NOAA-18 and NOAA-N', the AMSU-B instrument within ATOVS is replaced by the MHS instrument. The ATOVS instruments in particular are as follows:

1) HIRS/4: HIRS/4 measures the temperature and humidity of the global atmosphere in cloud-free or partly cloudy conditions (Metop-A and -B only). It is a filter-wheel radiometer, which measures radiances at 19 infrared channels, and one additional channel in the visible. One important improvement of HIRS/4 is the 10-km IFOV in contrast to the 20-km IFOV of the previous HIRS version.

2) AMSU-A: AMSU-A measures the temperature of the global atmosphere in nearly all weather conditions. It provides microwave atmospheric measurements in 15 channels between 23.8 and 89 GHz, mainly for temperature sounding.

3) MHS: MHS provides atmospheric measurements in five microwave channels for humidity measurements. The MHS instrument has been developed under EUMETSAT responsibility and replaces the previous generation AMSU-B microwave humidity sounder. MHS has been flying on NOAA-18—which is the first component of the IJPS in space—since May 2005.

**AVHRR/3.** AVHRR is a six-channel imager and provides globally visible, near-infrared, and infrared imagery of clouds, the ocean, and land surface. The Advanced Very High Resolution Radiometer is identical to the visible, near-infrared, and infrared imager flown on the NOAA–KLM-type satellites. Its data will be provided globally at the full resolution of 1.1 km at nadir.

**GRAS.** GRAS measures the temperature of the upper troposphere and the stratosphere with high vertical resolution in all weather conditions and potentially measures humidity in the troposphere (Luntama 2001). GRAS makes use of the GPS constellation. This constellation nominally consists of 24 satellites (at present there are 30 usable satellites) distributed in six orbital planes around the globe. An occultation occurs for GRAS whenever a GPS satellite rises or sets and the ray path from its transmitter traverses the Earth’s atmospheric limb (Fig. 3). The bending angle attributable to this ray contains information on the refractivity and hence on temperature and humidity; this information will be very useful for Numerical Weather Prediction. With the nominal 24 GPS satellites, a single GRAS instrument in near-polar orbit at 824 km would observe over 500 occultations per day, distributed quite uniformly over the globe. From assimilation experiments with CHAMP data one can deduce that GRAS measurements will provide good temperature information in the upper troposphere and lower stratosphere and over the polar regions (Collard and Healy 2003).

**ASCAT.** ASCAT provides near-surface wind speed and direction over the global oceans. The ASCAT on board Metop is a real aperture, vertically polarized C-band radar with high radiometric stability. ASCAT is an improvement of the SCAT instrument on the ERS satellites and provides the capability to measure near ocean surface winds. It will double the coverage of the surface

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Fig. 3. Radio occultation measurement principle (Comet see www.meted.ucar.edu/EUMETSAT/eps/print.htm).
(compared to SCAT) by having two swaths of measurements, one on each side of the subsatellite track.

Six ASCAT antennas illuminate the surface sequentially with long pulses at a carrier frequency of 5.225 GHz. The backscatter signal is measured to determine the specific surface backscattering. Wind speed and direction are estimated using a model, which relates them to the normalized radar backscattering cross section ($\sigma^0$). The data are collected from three azimuth angles (40°, 90°, and 145°) across both of the 550-km-wide swaths on both sides of the nadir track. The ASCAT design aims to provide ocean surface winds at 50-km resolution over a $25 \times 25$ km$^2$ grid along and across both swaths. In addition a high-resolution wind product is generated at 25-km horizontal resolution, using a $12.5 \times 12.5$ km$^2$ grid.

**GOME-2.** GOME-2 provides profiles of ozone and other atmospheric constituents. It is a medium-resolution UV-VIS spectrometer, fed by a scan mirror that enables across-track scanning in nadir as well as side view for polar coverage and instrument characterization using the moon as a source of light. In addition, the scan mirror can be directed to internal calibration sources and to a diffuser plate for solar calibration measurements.

The instrument provides measurement data in four optical channels that have continuous spectral coverage between 240 and 790 nm, with a spectral resolution between 0.25 nm at 240 nm and 0.5 nm at 790 nm. The spectra are focused on linear detector arrays of 1024 pixels each. (Fig. 4 shows the first level 0 spectrum received after instrument switch-on). There are two PMDs, which measure linearly polarized intensity in two perpendicular directions. The PMDs have similar detector arrays. The GOME-2 instrument on Metop benefits from the experience gained over more than 10 years of operations and data analysis with the GOME-1 instrument on ERS-2 (Hahne 1997).

**EPS PRODUCTS.** Operational meteorology comprises a wide range of activities related to the analysis and prediction of the changing weather elements in time. To help in the understanding of climate, and changes in climate, Earth observations make an important contribution. Operational satellites can provide the necessary long-term monitoring capabilities and thus contribute to the detection and documentation of climate change. Many requirements for climate monitoring coincide with or overlap with the mission requirements for operational meteorology. EPS capabilities include the operational sounding of temperature and humidity and associated by-products, measurement and monitoring of ozone, greenhouse and trace gases, ocean and land surface observations, ice observations, and precipitation.

**Temperature and moisture sounding.** Most of the scientific payload on Metop contributes to the operational sounding of temperature and moisture. The ATOVS instruments and the IASI instrument are used in a synergistic way. The AVHRR/3 imager supports their use.

IASI, the most innovative instrument on Metop, provides hyperspectral sounding resolution and high vertical resolution required by global NWP. It will provide global measurements of temperature and water vapor with unprecedented accuracy (1 K at 1-km vertical resolution; 10% relative humidity). In addition, the retrieval of greenhouse gases such as ozone, nitrous oxide, carbon dioxide, and methane will be retrieved and will contribute to environmental change monitoring (Turquety et al. 2004). Furthermore, surface temperature, surface emissivity, and cloud characteristics will be retrieved from IASI data. The AIRS on NASA’s *Aqua* satellite has demonstrated the capabilities of hyperspectral infrared sounders and their impact for Numerical Weather Prediction and greenhouse gas monitoring (Chahine et al. 2006; Le Marshall et al. 2006). The accuracy and the performance of the IASI/EPS retrieval algorithms have been demonstrated with space-based data from AIRS as well (Calbet et al. 2006). A full retrieval suite of global temperature and humidity profiles will be provided from the ATOVS/AVHRR suite (Klaes et al. 2005).
Ozone, greenhouse, and trace gases. Monitoring the evolution of atmospheric ozone has been established as a firm requirement because of its important consequences for the UV radiation field. Because of the effects of aerosol and trace gases on the Earth’s radiation budget, measurements of their concentration are key climate observables. These measurements will also play an important role in Numerical Weather Prediction. The GOME-2 and IASI instruments will monitor the ozone total column and profiles, aerosols, and trace gases, including components related to the ozone chemistry in the atmosphere.

A number of products are expected to be derived from GOME-2. The trace gases involved in the ozone chemistry are among them. It is expected that the vertical column amount of BrO, OClO, NO$_2$, and SO$_2$ will be retrieved at an accuracy of better than 20%. Ozone total columnar amount and ozone profiles are expected to be retrieved with an accuracy better than 5% and 15% above 30 hPa and better than 50% below 30 hPa, respectively. The objective is 3% for columns and 10% accuracy for ozone profiles at all levels. Additionally, it is expected that aerosol properties, such as AAI, AOD, and aerosol type (desert dust, smoke, and volcanic ash) can be derived. Finally clear-sky and cloudy UV fields may be derived.

The retrieval of the trace gases like N$_2$O, CO$_2$, SO$_2$, and CH$_4$ is expected to be possible with IASI, using the spectral regions from 1210 to 1650 cm$^{-1}$ (6.06–8.26 μm; CH$_4$, N$_2$O, and SO$_2$ column amounts), 2100 to 2150 cm$^{-1}$ (4.65–4.76 μm; CO column amount), 2150 to 2250 cm$^{-1}$ (4.44–4.76 μm; N$_2$O and CO$_2$), and 2700 to 2760 cm$^{-1}$ (3.62–3.7 μm; CH$_4$ column amount). The IMG instrument on ADEOS demonstrated some of the capabilities of high spectral resolution interferometers to allow the retrieval of trace gases (Chazette et al. 1998; Clerbaux et al. 1999). There are indications that the change of CO$_2$ could be monitored using IASI data (Chédin 1999).

Ocean surface observations. The use of AVHRR/3 measurements for the measurement of SST has a long heritage (Schlüssel et al. 1987; Emery et al. 1994). The IASI instrument will also be capable of providing information on SST as well as contributing to the atmospheric correction necessary for the retrieval of SST with AVHRR. With the 1.6-μm channel, AVHRR will have improved capabilities to distinguish between sea ice and clouds. It also distinguishes between snow and cloud, which is important, as sea ice is often covered by snow. Furthermore, the distinction of clouds at different levels can be performed more accurately (Hillger 1999). Further AVHRR capabilities include, besides cloud monitoring and analysis, the retrieval of atmospheric aerosol.

AVHRR has the potential to provide wind information in cloudy polar regions, where the swaths have sufficient overlap. Clear-sky winds are not possible to be retrieved because of a lacking water vapor channel on AVHRR (Key et al. 2005). EUMETSAT is planning to implement AVHRR-based polar winds as an EPS day-2 product.

Atmospheric winds are an important parameter in Numerical Weather Prediction. Wind contains information about the atmospheric mass field and hence temperature advection. Scatterometer observations provide surface wind vectors over the oceans, where conventional observations are sparse. On the ground, ASCAT source packets are processed to obtain normalized backscatter measurements, resulting in 21 nodes per swath (42 in total) for the 50-km resolution winds, and 42 nodes per swath (84 in total) for the 25-km resolution winds. The aim is to measure the ocean wind field at the ocean surface at an accuracy of 10% in the wind speed components and 20% in the direction. Figure 6 shows an example of ocean vector

![Fig. 5. Columnar amount of NO$_2$ over Europe, retrieved from GOME-2 on 4 Feb 2007, derived by the ozone-monitoring SAF (source: DLR, German Aerospace Center).](image-url)
winds, retrieved from early precalibrated ASCAT data.

Further potential of ASCAT lies in the measurement of sea ice boundaries and sea ice concentration and type (e.g., Cavanié et al. 1997). Other emerging applications are related to land surface observations.

**Land surface and ice observations.** To achieve data coverage over land with conventional measurements is difficult, in particular over remote areas and also for specific parameters like soil moisture. Satellite-derived products can provide the best coverage. A number of land surface observations like surface temperature, soil moisture, vegetation and snow cover, and fires can be derived from satellite data (see, e.g., Mohr and Schmetz 2006).

Land surface applications have been performed with AVHRR for a long time. These include the Normalized Differential Vegetation Index (e.g., Derrien et al. 1993), desertification monitoring, fire detection, and snow cover monitoring. The 1.6-μm channel added additional capabilities, in ice/cloud distinction and also in fire detection via the smoke plumes, which can be distinguished from the surface. Further application include evapotranspiration retrieval and crop monitoring.

Many scatterometer applications over land have been demonstrated using SCAT data from the ERS satellites (Woodhouse and Hoekman 1997; Kerkmann and Klaes 1998). There are new methods for the retrieval of soil moisture (Wagner 1998), which will be exploited operationally with ASCAT data in the EPS Ground Segment to provide information for global NWP in near–real time. Further applications of ASCAT data may include the monitoring of snow and ice coverage (Wismann and Boehnke 1997) and vegetation type and coverage (Boehnke and Wismann 1997). With ASCAT data such applications will be further developed toward operational use.

**EPS DATA PROCESSING AND DISSEMINATION.** The EPS Ground Segment is composed of a centralized part called the CGS, along with the UMARF at EUMETSAT headquarters in Darmstadt, Germany, and a decentralized part, which consists of centers called SAFs hosted by EUMETSAT member states’ meteorological services (see also Schmetz et al. 2002).

EPS provides a number of services, which range from the provision of global products to the support of a humanitarian SAR.

The products and services that will be provided by the EPS System are as follows:

- Global data at level 1 (geolocated and calibrated) in NRT, with 2.25-h delivery delay from sensing; these data will be provided through EUMETSAT’s EUMETCast service from the CGS, with most products in BUFR format. The details of the product contents can be found on EUMETSAT’s EPS Web site. As an example, Fig. 7 illustrates the global data from MHS, received from Metop-A.

- Selected global level 2 (estimates of geophysical quantities) products are produced in the CGS with a delivery delay of 3 h from sensing. These are ATOVS- and IASI-based vertical sounding products, that is, temperature and humidity profiles, and also ozone and trace gas information from IASI. The products will also be provided in BUFR format. Figure 8 provides an example of a temperature profile that was obtained from AIRS data with the IASI level 2 algorithm and compared...
against ECMWF and radiosonde data (Calbet et al. 2006).

- Local real-time observations are nominally provided by an AHRPT and LRPT service. Note that LRPT was switched off until further notice due to an interference with HIRS/4. The former provides data to direct readout users, who can receive all the data as measured, when the satellite is in view of their receiving station. These users will have to do the processing (navigation and calibration) themselves and need calibration as well as orbit information. One possibility is the use of the AAPP, which had originally been developed under EUMETSAT coordination (Klaes and Perrone 1993) and is now maintained by the NWP SAF (www.metoffice.gov.uk/research/interproj/nwpsaf/aapp/index.html). AHRPT contains all instrument data at full spectral and spatial resolution. LRPT is a subset of AHRPT containing the complete ATOVS sounding data and a set of three JPEG-compressed AVHRR channels.

- ATOVS level 1 and ASCAT level 2 products received from local stations will be reassembled and retransmitted via the EARS. The service covers nearly all of the Northern Hemisphere with a delivery delay of 30 min. For more information, refer to the EUMETSAT Web site, where a specific section on EARS can be found (www.eumetsat.int/Home/Main/What_We_Do/Satellites/EARS_System/DF_SAT_EARS?1=en).

- Most of the level 2 and higher products will be generated in the decentralized component of the EUMETSAT Ground Segment, the SAFs. They receive all level 1 and level 2 products from the central facility. In general, the dissemination of these products is via EUMETCast, the GTS or RMDCN.

- All products are archived in the UMARF. Catalog information of the SAF archives is located in the UMARF, so that users can access all products through the UMARF interface.

- When GRAS was first introduced as a payload, it quickly became clear that this meant the imple-
mentation of a complete system. Several spacecraft are involved with onboard clocks, which have errors and hence contribute to errors in the measurements. EUMETSAT needed to have a ground-based set of reference stations (the GRAS Support Network). The satellites used for an occultation measurement can be seen from those stations at the same time, and one can attempt to mitigate or eliminate the clock errors through clock estimation and differencing. There are 24 stations worldwide, which provide a redundancy of about 200% and thus ensure operational availability. The service is provided by ESA/ESOC.

**SUMMARY AND CONCLUSIONS.** The EPS system assures, on the one hand, continuity of the current system through the proven ATOVS instrument suite and the AVHRR imager. On the other hand, it implements highly innovative features. They can be emphasized as follows:

- High spectral resolution soundings provide high vertical resolution temperature and humidity profiles as well as trace-gas columnar amounts. Enhanced data streams will be available, which are needed to further improve the capabilities of advanced NWP systems.
- Commitment for more than a decade assures a service that goes beyond operational meteorology and enables EUMETSAT to contribute to climate monitoring and support climate research. Hyperspectral sounding, with IASI, and high-vertical-resolution temperature and humidity sounding, with GRAS, hold great promise (Goody et al. 2002).
- Instruments are embarked that build on the heritage of Earth observation missions. The ASCAT and GOME-2 instruments are introduced into an operational environment and represent EUMETSAT’s commitment to provide NRT and offline operational products from these instruments for a period of at least 14 yr.
- GRAS is an alternative concept for retrieval of temperature, moisture, and electron density with strong potential for climate monitoring.

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**APPENDIX: LIST OF ACRONYMS**

- AAI: Absorbing Aerosol Indication
- AAPP: ATOVS and AVHRR Processing Package
- ADEOS: Advanced Earth Observation Satellite
- AHRPT: Advanced High Resolution Picture Transmission
- AIRS: Atmospheric Infrared Sounder
- AMI: Active Microwave Instrument
- AMSU: Advanced Microwave Sounding Unit
- AOD: Aerosol optical depth
- ASCAT: Advanced Scatterometer
- ATOVS: Advanced TIROS Operational Vertical Sounder
- AVHRR: Advanced Very High Resolution Radiometer
- BUFR: Binary Universal Form for the Representation of Meteorological Data
- CGS: Core ground segment
- CHAMP: Challenging Mini Satellite Payload
- CNES: Centre National d’Etudes Spatiales
- DLR: Deutsches Zentrum für Luft- und Raumfahrt
- EARS: EUMETSAT Advanced Retransmission Service
- ECMWF: European Centre for Medium-Range Weather Forecasts
- EPS: EUMETSAT Polar System
- ERS: European Remote Sensing Satellite
- ESA: European Space Agency
- ESOC: European Space Operations Centre
- EUMETSAT: European Organisation for the Exploitation of Meteorological Satellites
- FMI: Finnish Meteorological Institute
- GNSS: Global Navigation Satellite System
- GOME: Global Ozone Monitoring Experiment
GPS  Global positioning system
GRAS  GNSS Receiver for Atmospheric Sounding
GSN  GRAS Support Network
GTS  Global Telecommunication System
HIRS  High Resolution Infrared Radiation Sounder
IASI  Infrared Atmospheric Sounding Interferometer
IFOV  Instantaneous field of view
IIS  Integrated Imager System
IJPS  Initial Joint Polar System
IMG  Interferometer Monitor for Greenhouse Gases
IR  Infrared
JPEG  Joint Photographics Expert Group
KNMI  Koninklijk Nederlands Meteorologisch Instituut
LRPT  Low Resolution Picture Transmission
LST  Local Solar Time
Metop  Meteorological Operational Satellite
MHS  Microwave Humidity Sounder
NASA  National Aeronautics and Space Administration
NDVI  Normalized Differential Vegetation Index
NIR  Near infrared
NOAA  National Oceanic and Atmospheric Administration
NRT  Near–real time
NWP  Numerical Weather Prediction
OPD  Optical path difference
PLM  Payload Module
PMD  Polarization Measurement Device
POES  Polar Operational Environmental Satellite
RMDCN  Regional Meteorological Data Communication Network
SAF  Satellite Application Facility
SAR  Search and Rescue mission
SCAT  Scatterometer
SST  Sea surface temperature
SSU  Stratospheric Sounding Unit
SVM  Service Module
TIROS  Television Infrared Operational Satellite
UMARF  Unified Meteorological Archive and Retrieval Facility
VIS  Visible

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