

Romania's cooperation with EUMETSAT

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Contents:

- **Introduction**
- **Satellite meteorology timeline**
- **Romania contribution to the EUMETSAT mandatory and optional programs**
- **EUMETSAT Satellite Application Facilities (SAFs) in meteorology and climatology**
- **EUMETSAT data/products for air traffic meteorological assistance and protection**
- **Conclusions**

Introduction

- EUMETSAT (The European Organization for the Exploitation of Meteorological Satellites) is an intergovernmental organization created in 1986, through an international convention agreed by a current total of **30 European Member States**.
- EUMETSAT's primary objective is to establish, maintain and exploit European systems of operational meteorological satellites. EUMETSAT is responsible for the launch and operation of the satellites and for delivering satellite data to end-users as well as contributing to the operational weather forecast and monitoring and the detection of global climate changes.
- The activities of EUMETSAT contribute to a global meteorological satellite observing system.
- EUMETSAT Member States contribute financially and scientifically to the development and exploitation of the satellites, while the national industries are benefiting from the contracts awarded for the research and development of the space systems.
- The main beneficiary of the EUMETSAT activities is the European citizen: satellite data is an important contributor to the accuracy of weather forecasts across the continent and the globe.
- **Romania is no exception, clearly benefiting from the use of high quality, reliable satellite data in operational meteorology, climatology, research and education.**

Satellite Meteorology Timeline

- ❖ 1960 NOAA launches TIROS I, the first weather satellite;
- ❖ **1970** First weather satellite receiving station in Romania, installed at the National Meteorological Administration (Meteo Romania) (NOAA APT, Hawker-Sidley);
- ❖ 1977 Meteosat-1 launched;
- ❖ **1984** First Meteosat SDUS (Secondary Data User Station) in Romania, operational at the National Meteorological Administration;
- ❖ **1988** First METEOSAT PDUS (Primary Data User Station) in Romania; operational at the National Meteorological Administration;
- ❖ **1989** First NOAA HRPT ground station in Romania at Meteo Romania (ICE);
- ❖ **1986** Creation of EUMETSAT;
- ❖ **2004** Romania becomes a EUMETSAT **cooperating state**;
- ❖ 2004 Meteo Romania and EUMETSAT organize the first EUMETSAT course in Romania;
- ❖ 2005 Meteo Romania joins EUMETSAT/ Nowcasting SAF beta testing program;
- ❖ 2007 NMA is granted a license to use operationally the EUMETSAT Nowcasting SAF software MSG/PPS;
- ❖ **2010** Romania becomes the 25th EUMETSAT **full member state**.

Romania contribution to the EUMETSAT programs

As stipulated in the EUMETSAT Convention, mandatory programs are those in which **all Member States** participate, which are: (a) the Meteosat Operational Program (MOP); (b) the basic programs required to continue the provision of observations from geostationary and polar orbits; (c) other programs as defined as such by the Council.

Mandatory programs and the General Budget are established through the adoption of a Program Resolution by the Council, to which a detailed Program Definition, is attached.

The annual contributions is be based on the pro-rata of the Member States' **Gross National Income** (GNI), calculated as an average of the GNI figures for the latest three years for which the relevant statistics provided by the Statistical Office of the European Union (EUROSTAT) are available.

Romania contributes to all of the EUMETSAT mandatory programs and to the Jason 2 and Jason 3 optional programs.

EUMETSAT Mandatory Programs (1)

➤ **Meteosat Transition Program (MTP)**

The MTP program was established to ensure the operational continuity between the end of the Meteosat Operational Program (1995) and Meteosat Second Generation (MSG), which came into operation in 2004 using improved satellites.

➤ **Meteosat Second Generation (MSG) Program**

MSG was designed in response to user requirements to serve the needs of Nowcasting applications and numerical weather forecasting.

2004 - MSG-1 (renamed to Meteosat-8); In addition to the main optical payload SEVIRI (Spinning Enhanced Visible and Infrared Imager), Meteosat-8 also carries the secondary payload GERB (Geostationary Earth Radiation Budget) instrument.

2005 - MSG-2 (renamed to Meteosat-9), provides an operational European '**rapid scan**' mode service, with images of Europe **every 5 minutes**.

2012 - MSG-3 (renamed to Meteosat-10) provides the main full Earth imagery service over Europe and Africa (with images every 15-minutes).

2015 - MSG-4 (renamed to Meteosat-11).

➤ **Meteosat Third Generation (MTG) Program**

The MTG program will provide continuity of MSG services and will guarantee access to space-acquired meteorological data until at least the **late 2030s**.

- ❖ Twin Satellite Concept, based on 3-axis platforms.
- ❖ Four Imaging Satellites (MTG-I) (20 years of operational services expected).
- ❖ Two Sounding Satellites (MTG-S) (15.5 years of operational services expected).

EUMETSAT mandatory programs (2)



➤ EUMETSAT Polar System (EPS) Program

EUMETSAT Polar System (EPS) **Metop** consists of satellite, positioned at 817 km above the Earth, that can deliver details information about atmospheric temperature and moisture profiles.

The satellites also ensure that the more remote regions of the globe, particularly in Northern Europe as well as the oceans in the Southern hemisphere, are fully covered.

The EPS program is also the European half of a joint program with NOAA, called the **International Joint Polar System** (IJPS).

Many of the instruments on Metop are also operated on Polar-orbiting Operational Environmental Satellites (POES), providing similar data types across the IJPS.

2006 – launched of the first EPS satellite, Metop-A;

2012 – launched of the second EPS satellite, Metop-B;

2017 – the third Metop-C, scheduled for launch.

EUMETSAT Mandatory Programs (3)

➤ EUMETSAT Polar System Second Generation (EPS-SG) Program

EPS-SG represents Europe's contribution to the future Joint Polar System (JPS), which is planned to be established together with the NOAA, following on from the Initial Joint Polar System (IJPS).

Polar orbiting satellites, due to their global coverage and of the variety of passive and active sensors that can be deployed from Low Earth Orbits, have a very significant positive impact on **Numerical Weather Prediction (NWP)**.

The Initial Joint Polar System (IJPS), shared by EUMETSAT and NOAA, currently accounts for around 45% of the total error reduction on Day 1 forecasts achieved by all types of observation ingested in real-time by NWP models.

Polar orbiting satellites also deliver unique infrared and microwave imagery inputs to critical nowcasting of high impact weather at high latitudes.

The EPS-SG will provide continuity of observations and respond to the needs of the users in the **2020–2040 time frame.**

EUMETSAT Optional Programs

- **JASON-2 Altimetry Program**
- **JASON-3 Altimetry Program**

Jason-2 and 3 deliver detailed oceanographic data vital to our understanding of weather forecasting and climate change monitoring. The radar altimeters on Jason-2 and 3 are essential components of a global ocean observation system, providing co-located measurements of significant wave height, wind speed and sea surface topography.

EUMETSAT Satellite Application Facilities (SAFs) in meteorology and climatology

- ❖ EUMETSAT supports Satellite Application Facilities (SAFs) organized as a distributed network of thematic application facilities responsible for necessary research, development, and operational activities not carried out by the central facility.
- ❖ Utilizing specialist expertise from the Member States, SAFs are dedicated **Centers of excellence** for processing satellite data. They form an integral part of the distributed EUMETSAT Application Ground Segment.
- ❖ **The eight EUMETSAT SAFs** provide users with operational data and software products, each one for a dedicated user community and application area.

In Romania the SAF products are widely used in operational meteorology and climatology, as well as in research and education activities.

Satellite Application Facilities (SAFs) (1)

Satellite Application Facility on Land Surface Analysis (LSA)

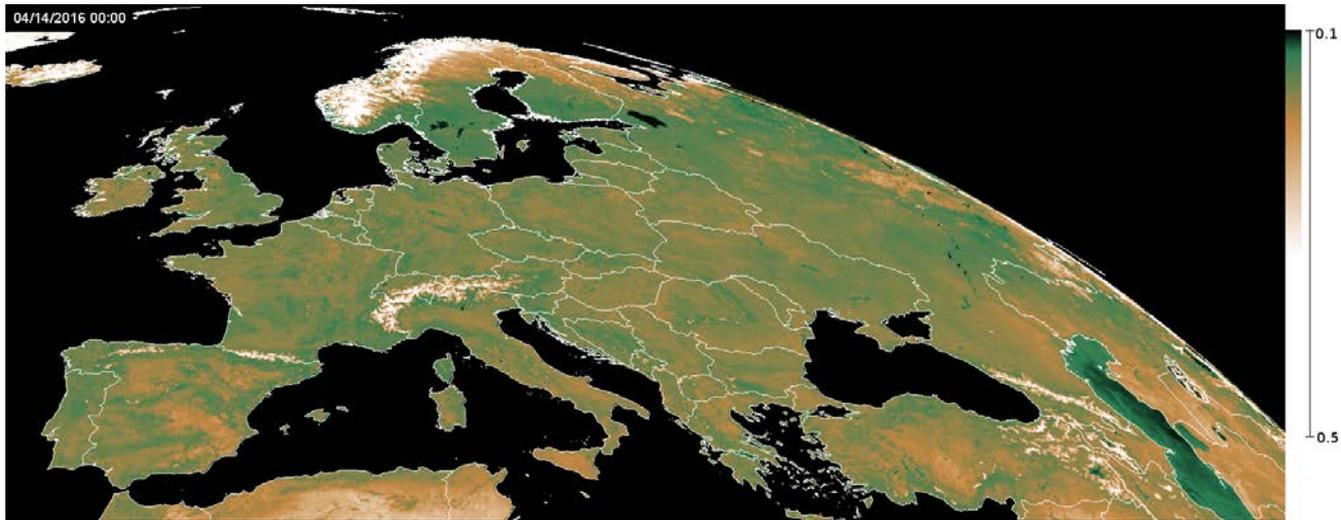
The aim of the LSA SAF is to take full advantage of remotely sensed data on **land, land-atmosphere interactions and biosphere applications**. A strong emphasis is put on developing and implementing algorithms that will allow an operational use of data from EUMETSAT satellites. The LSA SAF system, generates, archives and disseminates, on an operational basis, a set of parameters involved in the surface radiation budget, evapotranspiration, vegetation cover and fire-related products.

LSA SAF addresses a wide user community, ranging from surface processes modelling e.g. Numerical Weather Prediction (NWP), seasonal forecasting and climate models to agriculture and forestry applications e.g. fire hazards, food production and hydrology.

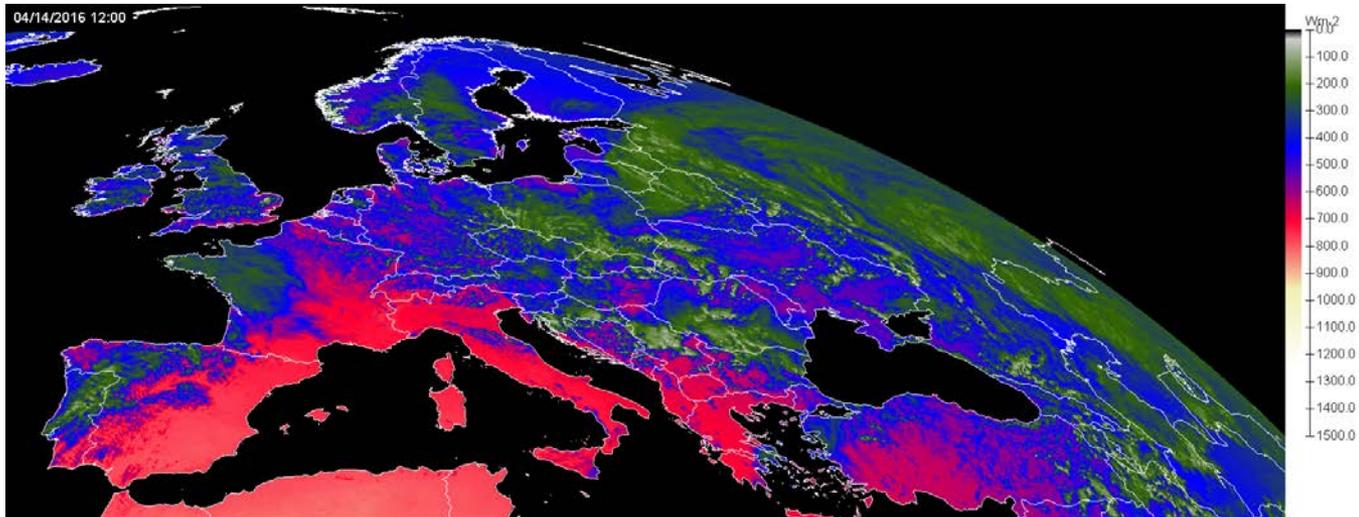
Users benefit from products generated from a reliable observing system, designed to ensure long-term operations.



LSA SAF products



Albedo - Europa 14.04.2016,
00:00 UTC



Downward Surface Shortwave
Flux - 24.04 2016, 12:00 UTC

Satellite Application Facilities (SAFs) (2)

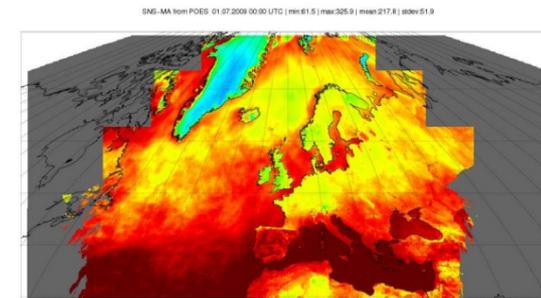
Satellite Application Facility on Climate Monitoring (CM SAF)

The CM SAF generates and archives high-quality datasets for **specific climate application areas**, through the exploitation of satellite measurements with state-of-the-art algorithms.

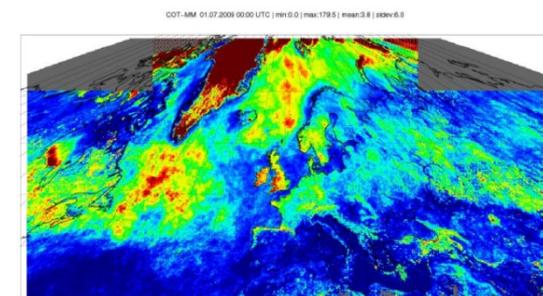
The CM SAF provides data that can be further used to:

- ❖ assess the **climate variability and change**, including climate change detection and attribution;
- ❖ support the development of **climate models**;
- ❖ validate **long-range and short-term climate forecasts**;
- ❖ assess the **impact of changing environment**, and to provide evidence for policy actions.

The applications cover the objectives of various international programs — such as **Global Climate Observing System (GCOS)**, **World Climate Research Program (WCRP)** — and are also vital for activities within the **Group on Earth Observations (GEO)** and **Copernicus framework**.



Surface Net Solar Radiation (W/m^2)



Cloud optical thickness

Satellite Application Facilities (SAFs) (3)

Satellite Application Facility on Support to Nowcasting & Very Short Range Forecasting (NWC SAF)

The main goal of the NWC SAF is to produce **software packages that support Nowcasting and Very Short Range Forecasting**. The software, which is for local installation at the user's site, processes data from operational meteorological satellites on geostationary or polar orbits.

Satellite data that are processed with the NWC SAF software: MSG (SEVIRI), Metop and NOAA (AVHRR/AMSU/MHS), Soumi NPP (VIIRS).

The activities also encompass the extension of the applicability to future satellite systems, including the Meteosat Third Generation (MTG) and Soumi NPP.



Nowcasting SAF (NWC SAF)

Meteo Romania joins EUMETSAT's NWC SAF Consortium (Spain, France, Sweden, Austria, Romania) and will participate in the next Continuous Development and Operations Phase (CDOP-3), 2017-2021.

The NWC SAF vision is to be a Reference and Excellence Centre for processing satellite data for Nowcasting within EUMETSAT and worldwide.

The provision of the NWC SAF software for the processing of data from the new EUMETSAT programs Meteosat Third Generation (MTG-I imaging and MTG-S sounding satellites) and Polar System-Second Generation (EPS-SG) is one of the main objectives for the NWC SAF in the upcoming phase.

Meteo Romania will lead the following work packages in the forthcoming CDOP-3:

- NWP impact on geostationary (GEO) and polar platform systems (PPS) products;
- GEO/PPS Cloud Products comparison;
- Meteosat Third Generation lighting Imager prototype products.



Satellite Application Facilities (SAFs) (4)

Satellite Application Facility on Numerical Weather Prediction (NWP SAF)

The NWP SAF goal is to increase the benefits derived from **numerical weather prediction by developing techniques for more effective use of satellite data**, and to improve the exploitation of data and products from the EUMETSAT satellites.



The NWP SAF updates, assesses and prioritizes user requirements and develops the satellite data processing modules needed to meet those requirements. These include: pre-processing; retrieval and assimilation modules; modules for monitoring, tuning and quality control, and modules for validation of satellite products and of observation operators.

The **European National Meteorological Services are the NWP SAF's primary users**, but the tools it develops have a wide range of research and operational applications extending well beyond NWP.

NWP SAF products also underpin activities in international programs, such as the **Copernicus program**.

Satellite Application Facilities (SAFs) (5)

Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF)



The O3M SAF develops, produces, archives, validates and disseminates **ozone and atmospheric chemistry products**, to support the services of the EUMETSAT Member States in weather forecasting, as well as monitoring of ozone depletion, air quality and surface UV radiation.

In addition, these products contribute to the implementation of the EUMETSAT strategy in **environmental monitoring of the atmosphere**. This is achieved at the European level by contributing to the **Copernicus activities**, and in the global scale by implementing the global observations of the key atmospheric parameters, as recommended by the **Integrated Global Atmospheric Chemistry Observations Theme (IGACO)** within the IGOS framework.

Satellite Application Facility on Radio Occultation Meteorology (ROM SAF)



The ROM SAF generates and archives high-quality GPS Radio Occultation (RO) datasets for **Numerical Weather Prediction (NWP)** applications and specific climate application areas.

Satellite Application Facilities (SAFs) (6)

Satellite Application Facility on Support to Operational Hydrology and Water Management (H SAF)



The H SAF generates and archives high-quality datasets and products for operational hydrological applications.

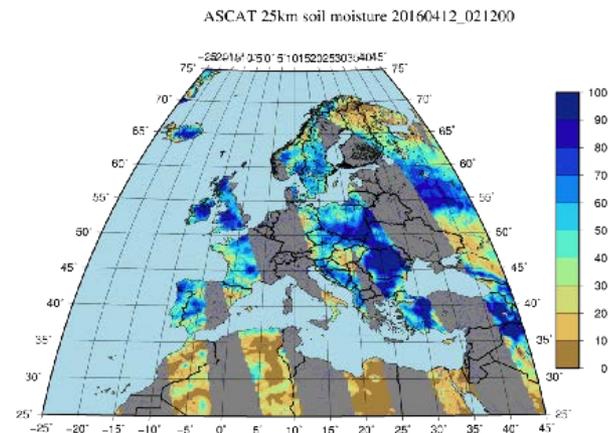
The retrieval of products uses data from microwave and infrared instruments for the best possible accuracy compatible with satellite systems available now, or in the near future.

The H SAF program focuses on the generation of products:

- ❖ Precipitation products
- ❖ Soil moisture products
- ❖ Snow parameters



Effective snow cover by VIS/IR radiometry
(8/04/2016)



Surface soil moisture by radar
scatterometer ASCAT (12/04/2016 02:12)

Satellite Application Facilities (SAFs) (7)

Satellite Application Facility on Ocean and Sea Ice (OSI SAF)

The OSI SAF provides comprehensive information on the **ocean-atmosphere interface** — requirements of both meteorology and oceanography.



The OSI SAF is an answer to requirements, from the meteorological and oceanographic communities of EUMETSAT Member and Cooperating States, for comprehensive information derived from meteorological satellites at the ocean-atmosphere interface. The OSI SAF **offers a precious complement to in-situ data**, based on continuously increasing temporal and geographical resolution products from coastal to global coverage.

It takes into account, in particular, the requirements expressed in the framework of the World Meteorological Organization (WMO), Global Climate Observing System (GCOS), Global Ocean Data Assimilation Experiment (GODAE GHRSSST-PP), and, finally, **Copernicus** and its Large Integrated Project **MyOcean**.

EUMETCast DVB-S2 upgrade

- In the framework of the Project "Developing of the national system for monitoring and warning of extreme weather phenomena for the protection of life and property", financed within the Sectoral Operational Programme - Environment (2007-2013), **Priority Axis 5 POS Environment**, MeteoRomania has upgraded in 2015 its **Satellite Receiving & Processing System to meet the new DVB-S2 EUMETCast data broadcasting standard** and insuring access to the High Volume Service.
- The new hot-standby EUMETCast system provides the National Weather Forecasting Centre with uninterrupted, **real-time access to the 0° Service (Meteosat-10) at 15 minutes repeat cycle** and to the **9.5° (Meteosat-9) at 5 minutes repeat cycle** imagery and products in real-time.
- Also, other European and foreign satellite imagery and products provided by EUMETSAT through the **EUMETCast service** (Metop A and B, NOAA 19, GOES 13 and GOES 15, Himawari-8 etc.) are available to operational and research activities.

The DAWBEE EUMETSAT project

(Data Access for Western Balkan and Eastern European Countries)

- ❖ The DAWBEE project main purpose was to ensure that 6 Eastern European Countries and 5 Western Balkan Countries have operational access to EUMETSAT data.
- ❖ Through this project the activities have been conducted in view of:
 - Supporting the installation in non-equipped countries of a “standard” EUMETCast station, with an appropriate training for the operation of the station;
 - Creating a self-sustained network of experts across the countries that could pursue collaboration beyond the end of the proposed activity.
- ❖ National Weather Services from 6 EUMETSAT member and cooperating states (Romania, Bulgaria, Croatia, Slovenia, Slovakia and Ukraine) have been invited to join EUMETSAT in this project. These experts have been trained by EUMETSAT for the on-site installation of the DAWBEE satellite stations and local training. The deployment of the DAWBEE stations and training of the local staff in each of the 11 countries has been successfully completed.
- ❖ **MeteoRomania** expert Team provided on site, assistance to **the MetService of Republic of Moldavia for the installation of the DAWBEE EumetCast station** and trained the local staff in the operation of the system.



EUMETSAT data/products for air traffic meteorological assistance and protection

The **Romanian Air Traffic Services Administration (ROMATSA)** provides meteorological services for the international air navigation. Their main goal is to contribute to the safety, the smooth flow and the efficiency of the international air navigation.

The operational use of the EUMETSAT satellite data led to a remarkable improvement of the **meteorological watch of the atmospheric phenomena in the Romanian airspace as well as of the aeronautic forecasts.**

The satellite data and products available in quasi real time, provide to the forecasters unique elements, that cannot be obtained by other technological means, regarding the **airspace dangerous meteorological conditions on the plane trajectory** (fog extension/dissipation, convective cloud systems evolution, turbulences, etc).

Conclusions

Of the 46 years of satellite meteorology in Romania, the past 32 years have been driven with EUMETSAT as the main source of weather satellite data, scientific excellence and technical know-how.

The last 6 years of partnership between EUMETSAT and Romania as a member state have been the most intense and rewarding.

We've seen Romanian companies start doing business with EUMETSAT, operational and research entities - with Meteo Romania leading the way, contributing their scientific & technical expertise in EUMETSAT projects, or young scientist and meteorologists specializing in cutting-edge space technologies.

As national weather service, looking at the challenges the forthcoming generation of Earth Observation satellites will bring, we are looking forward to an even tighter cooperation with EUMETSAT in the years to come.

Thank you for your attention !