

# EUMETSAT Strategy Challenge 2025



## Foreword

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According to its Convention, the primary objective of EUMETSAT, as an intergovernmental organisation, is to establish, maintain and exploit European systems of meteorological satellites, taking into account as far as possible the recommendations of the World Meteorological Organization (WMO).

A further objective is to contribute to the operational monitoring of the climate and the detection of global climatic changes.

This strategy provides the direction and scope of activities to be undertaken by EUMETSAT over the next decade.

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# EUMETSAT in a changing world



Since the adoption of the previous strategy, “EUMETSAT: a global operational satellite agency at the heart of Europe”, in 2011, the external environment has evolved in a number of respects that require a response from EUMETSAT

## Our society and economy demand further improvements of weather forecasts and warnings, calling for more and better observational inputs from space

In our changing climate, our society is becoming more and more sensitive to the impact of weather and less and less tolerant of inaccurate observations, forecasts and warnings. This is encouraging a growing number of governments and industries to actively manage weather risks as a core risk. At the same time, the general public is also increasingly aware of the value of forecasts now widely available in the media, on the Internet and via Smartphone apps and social media, and is demanding more weather information for safety and private use.

Most importantly, accurate forecasts and timely warnings save lives and avoid a significant proportion of the potential economic losses due to high-impact weather and natural or technological hazards, which are driven or influenced by weather (e.g. floods, droughts, wild fires).

From 1970 to 2012, 8,835 weather, climate and water-related disasters were reported worldwide, causing €2.2 trillion of economic losses and claiming 1.94 million lives, accounting for 74% of total reported losses and 61% of total lives lost in relation to all types of disasters<sup>1</sup>. Over the past four decades, the number of weather-related disasters and their cumulative economic losses has increased fivefold<sup>2</sup>.

In Europe alone, over the same period, weather-related disasters claimed about 90,000 lives<sup>3</sup> and caused at least €315 billion in economic losses. Floods and storms accounted for most of the economic losses while extreme temperatures caused 94% of deaths, including 72,210 during the 2003 heat

wave. More recently, floods caused losses of €18 billion and 22 lives in Central Europe in 2013 and, in 2014, hail storms and a series of intense extra-tropical storms caused losses of €4.4 billion in Germany and the United Kingdom<sup>4</sup>. In 2015, large hail events and thunderstorms over Belgium, France, Germany and the Netherlands and the winter storm Niklas, which swept across large areas of central Europe, generated losses of €3.9 billion<sup>5</sup>.

In 2015, the WMO reported that - owing to more accurate forecasts, earlier warnings and their integration into disaster risk reduction<sup>6</sup> systems - the overall number of lives lost worldwide had notably decreased, despite a growing number of weather-related disasters. However, further progress on saving lives and containing economic losses remains a major challenge for the next decade. This challenge is at the core of the Sendai Framework for Disaster Risk Reduction 2015-2030<sup>7</sup>, which cuts across most of the 17 Sustainable Development Goals adopted by the General Assembly of the United Nations on 25 September 2015 as part of its 2030 Agenda for Sustainable Development<sup>8</sup>.

More accurate forecasts and earlier warnings are also extremely valuable for the global economy and growth in Europe.

Indeed, recent economic studies<sup>9,10</sup> indicate that 25-30% of the Gross Domestic Product (GDP) of highly developed economies is weather-sensitive and that the socio-economic benefits of weather forecasts are proportional to GDP.

In Europe, these benefits were estimated at €61 billion per year for three areas, out of which €40 billion represents direct added value to the economy in vital sectors such as transport,

1 Munich Re, Geo Risk Research, January 2013

2 “Atlas of mortality and economic losses from weather, climate and water extremes (1970 – 2012)”, WMO-N° 1123, WMO and Centre for Research and epidemiology of disasters of the Université Catholique de Louvain (UCL), 2014

3 “Atlas of mortality and economic losses from weather, climate and water extremes (1970 – 2012)”, WMO-N° 1123, WMO and Centre for Research and epidemiology of disasters of the Université Catholique de Louvain (UCL), 2014

4 Munich Re, Geo Risk Research, January 2015

5 Munich Re, Geo Risk Research, June 2015

6 WMO strategic plan 2016 – 2019 (Cg-17 Doc.10.1 Rev.1)

7 <http://www.unisdr.org/we/inform/publications/43291>

8 [http://www.un.org/ga/search/view\\_doc.asp?symbol=A/RES/70/1&Lang=E](http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E)

9 US 2012 GDP, World Bank, AGS, NCAR and NSF study

10 “The Case for the Eumetsat Polar System (EPS)/Metop Second-Generation Programme: Cost Benefit Analysis” - Hallegatte, Stéphane (et al.) in “Yearbook on Space Policy 2011/2012: Space in Times of Financial Crisis” (Editors: Al-Ekabi, C., Baranes, B., Hulsraij, P., Lahcen, A.)





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energy, agriculture, tourism, food and construction. In the road transportation sector alone, the benefits accrued from forecasts of adverse weather preventing road accidents are in the order of €3.4 billion per year in Europe<sup>11</sup>. In the aviation sector, up to two-thirds of weather delays are avoidable with the use of precise forecasts, generating benefits worth €17.5 billion per year in the United States<sup>12</sup>.

Therefore, to be up to the challenge of sustainable development in the next decades and beyond and to meet the expectations from governments, citizens and industries, the members of the European Meteorological Infrastructure (EMI)<sup>13</sup> need to further improve their forecasts and early warnings of high-impact weather, and work in a multidisciplinary approach with other institutions involved in Disaster Reduction in order to tailor their products to these requirements.

As weather forecasts rely on the optimum combination of observations, numerical weather prediction (NWP) and human expertise, parallel and consistent improvements in all three areas are needed. In particular, more and better observations from space are required from EUMETSAT, because observations from meteorological satellites are critical for nowcasting (NWC) and to build the best possible initial state for numerical forecasts.

Indeed, the ECMWF has increased the number of satellite instruments used as sources of data ingested in its global model from 12 to 50 over the past 12 years, and recent studies have shown that satellite observations account for 64% of the reduction of errors in day-1 numerical forecasts<sup>14</sup>, with one EUMETSAT Metop satellite alone contributing 25%.



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Over the next decade, satellite data will need to fulfil the requirements of very high resolution, convection-resolving NWP models that will become available across all NMHSs and will be increasingly used for very short-range forecasts (VSRF), in conjunction with real-time observations. The ongoing development of seamless Earth system prediction systems that will address short- to extended-range forecasts of weather, atmospheric composition, the ocean and the cryosphere, on regional to global scales, is another driver of requirements.

Thus EUMETSAT's *raison d'être* will continue to be to develop and deliver observations to Member States, NMHS, the ECMWF and users worldwide, as critical inputs to forecasting and warnings of high-impact weather.

This calls for the delivery of seamless observations of weather, aerosols and atmospheric chemistry, ocean, sea-ice, cryosphere and land parameters by EUMETSAT, combining the frequent observations from geostationary orbits and less frequent, but global and more comprehensive, observations from low Earth orbits (LEO).

The primary response of EUMETSAT over the next decade will be to extract more and better products from its current satellite systems and to establish new, even more capable, systems through the realisation of all new EUMETSAT programmes approved by its Member States in the period 2011-2015, in particular the Meteosat Third Generation (MTG), EUMETSAT Polar System Second Generation (EPS-SG) and Jason-CS (Continuity of Service) programmes. EUMETSAT will also leverage further benefits to its Member States from its involvement in the European Union (EU) Copernicus Earth monitoring programme and also cooperation with international partners to cover additional requirements, including, for example, more frequent observational coverage of the Arctic, a region that is becoming increasingly important for weather forecasts over Europe.

11 *Impacts and value of weather forecasting improvements*, Pertti Nurmi, Adriaan Perrels and Vainö Nurmi, FMI, Royal Meteorological Society, 2013  
12 *U.S. Congressional Joint Economic Committee, May 2008 and REDAC weather-ATM Integration Working Group report, October 2007*  
13 *The European Meteorological Infrastructure (EMI) is formed by the European National Meteorological and Hydrological Services (NMHSs), their EUMETNET grouping, the European Centre for Medium-Range Weather Forecasts (ECMWF) and EUMETSAT*  
14 *"The impact of Metop and other satellite data with MET Office NWP system using an adjoint-based sensitivity method", S. Joo, J. Eyre and R. Marriot, UKMO, 2012*

## Weather and climate services for mitigation and adaptation to Climate change

According to the 5<sup>th</sup> Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) published in 2014<sup>15</sup>, *“warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.”*

Europe will not be spared. The southern areas, in particular, will experience droughts coinciding with a significantly increased demand for water for irrigation, industry and domestic use. In combination with wildfires threatening the entire region, this will affect agriculture and major industries. At the same time, Central and Northern Europe will experience more frequent and severe flooding. In combination with rising sea levels, this is resulting in *“coastal systems and low-lying areas increasingly experiencing adverse impacts such as submergence, coastal flooding and coastal erosion”*<sup>6</sup>.

As climate change is already a reality, the risk needs to be managed through suitable adaptation policies, while mitigation policies remain vital to contain emissions and the magnitude of climate change in the long-term. Both requirements are now acknowledged and supported by legal commitments captured in the Paris Agreement<sup>17</sup> adopted on 12 December 2015 by the 21<sup>st</sup> Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

Adaptation and mitigation strategies require a full combination of operational weather and climate information services built on solid scientific foundations, including observations, seasonal and decadal predictions, climate projections, climate analyses and assessments of impacts.

With the high vulnerability of society to extreme weather events and their expected increase in frequency and intensity<sup>18</sup> in the changing climate, authoritative early warning systems and their integration into disaster reduction management are a central element of adaptation. On the other hand, well-informed decisions on disaster risk reduction require real-time qualification of forecast or observed high-impact weather events against climate records and previous extremes, and only NMHSs can create this operational bridge between weather and climate services.

Therefore, NMHSs of EUMETSAT Member States are evolving into full weather and climate services following WMO guidelines and are best placed to interface with decision makers and users in each country, capitalising on the ECMWF's capability for medium-range weather forecasting and its new responsibility to provide the backbone Copernicus Climate Change Service (C3S) on behalf of the EU.

Meteorological satellites build the longest climate records from space - with more than 35 years of Meteosat data already available - and now observe the atmosphere, the ocean, the cryosphere and land surfaces on a global scale. Therefore, EUMETSAT, as part of the EMI, is also in the best position, capitalising on the infrastructure and expertise distributed across its headquarters in Darmstadt and its network of Satellite Application Facilities (SAFs), to recalibrate and reprocess long series of observations and to deliver climate data records (CDR) of essential climate variables (ECV). These are used directly for climate analysis or ingested into Earth system models used in "reanalysis" (hindcast) mode to produce consistent records of a broader range of climate variables, at global and regional scales.

Also, following the entry into force of its Jason-CS programme in September 2015, EUMETSAT will participate in the cooperative Jason-CS/Sentinel-6 high-precision ocean altimetry mission, together with the EU, European Space Agency (ESA), the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA). This programme will expand the unique mean sea level record, initiated in 1992 with Topex-Poseidon and continued with Jason, Jason-2 and Jason-3, into the 2020-2030 timeframe.



15 <https://www.ipcc.ch/report/ar5/>

16 IPCC report : Climate Change 2013, The Physical Science Basis, Summary for Policymakers

17 <http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf>

18 <http://www.unjsdr.org/we/coordinate/sendai-framework>



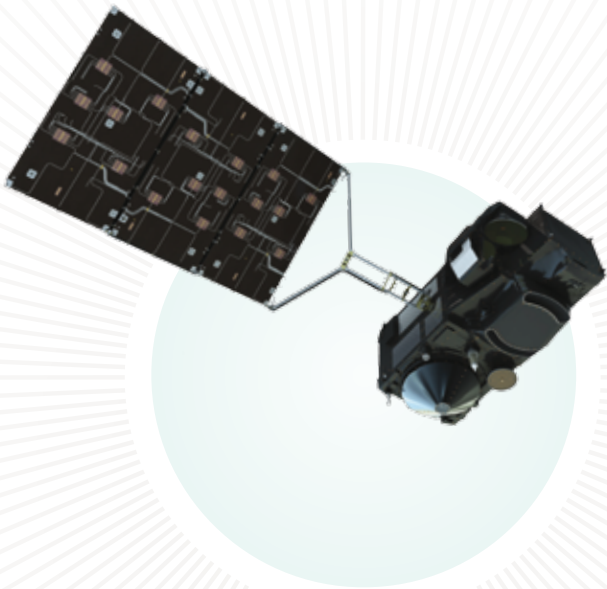
The sustained involvement of EUMETSAT in global observations of ocean surface topography, sea surface temperature and soon ocean colour, reflects the key role of the ocean in the climate system and the carbon cycle, but also, for the purpose of extended-range forecasting, as a driver of the predictability of the variability of the atmosphere from weeks to seasons and years. This is an essential part of the necessary bridge between weather and climate services.

**Copernicus is now a reality**

After the Galileo programme, the EU in 2014 adopted a second flagship space programme dedicated to Earth observation, named Copernicus. The objective is to *“ensure an autonomous capacity for space-borne observations and provide operational services in the field of atmosphere, marine, land and climate change monitoring, emergency management and security”*.

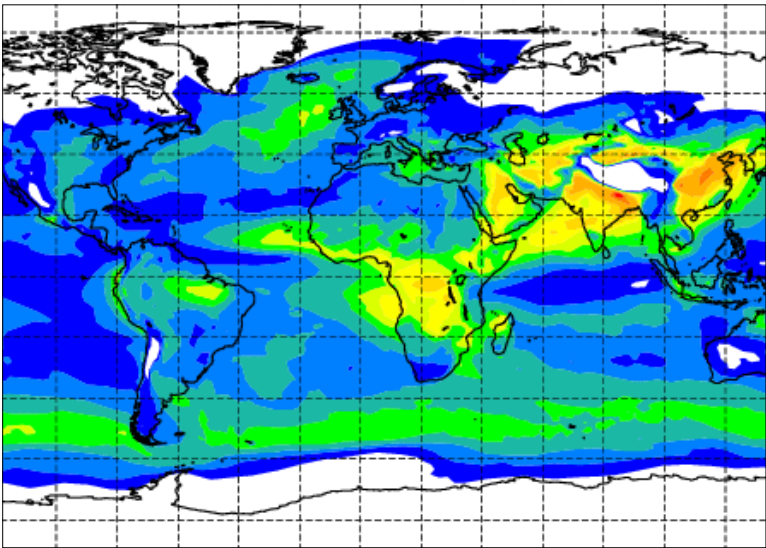
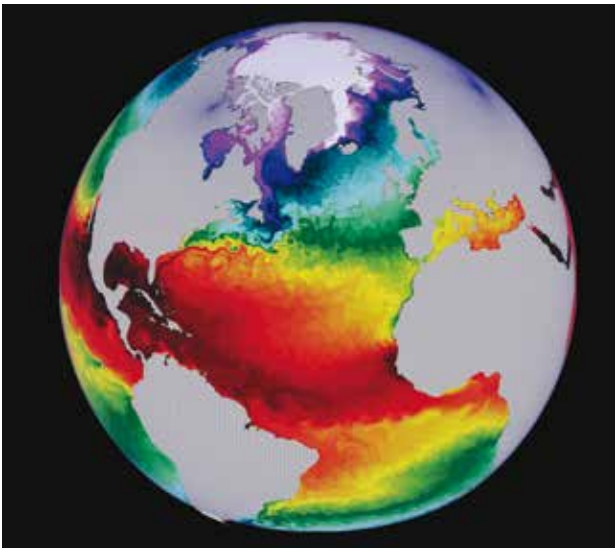
The portfolio of Copernicus operational information services includes the Copernicus Marine Environment Monitoring Service (CMEMS), provided by Mercator-Océan, and the Copernicus Atmosphere Monitoring Service (CAMS) and the Copernicus Climate Change Service (C3S), which are both provided by the ECMWF.

Following the signature of a Copernicus Agreement with the EU on 7 November, 2014, and the entry into force of its associated Third Party Programme, EUMETSAT is also firmly involved in the space component of Copernicus. From 2016 onwards, it will exploit the Jason-3 and Sentinel-3 marine missions, on behalf of the EU and in cooperation with ESA, and deliver data services with the maximum possible synergy with its own missions. It will also prepare for the Sentinel-4 and Sentinel-5 atmospheric composition missions implemented as part of its MTG and EPS-SG systems.



**The “big data” agenda**

The development of the “big data” agenda, involving cloud technologies and new paradigms on interfaces with users, will also be an important contextual element over the next decade. In Europe, the “big data” challenge is high on the agenda of the European Commission, as reflected in the Digital Agenda of DG Connect, in the evolution of the Copernicus ground segment considered by DG GROW and in the priorities of the Horizon 2020 Research and Innovation Programme.



Global Sea Surface Temperature (left, source: CMEMS/Mercator Océan)  
and Global Aerosol Optical Depth (right, source: CAMS/ECMWF)

A map of space debris orbiting the Earth (source: NASA)



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### Space Situational Awareness

The amount of space debris is steadily increasing and will continue to do so in the future with an annual launch rate of 60 to 70 new satellites, which might increase even further with the planned deployment of large constellations of hundreds of satellites to deliver global high-speed Internet.

Operationally, EUMETSAT will need to continue protecting its in-orbit assets using space situational awareness (SSA) services from providers in Europe and the US, including conjunction warnings and space weather services, and make sure its requirements are taken into account in discussions of relevant EU initiatives.

Also, the design of future EUMETSAT satellites will need to be compliant with applicable space debris mitigation standards, e.g. ISO 24113:2011, with possible impacts on maximum programme lifetimes.

### The economic situation remains difficult in Europe

A number of EUMETSAT Member States are still suffering from the economic crisis and exposed to severe reductions in public spending. Although Member States have now approved the mandatory MTG and EPS-SG programmes as long-term strategic investments, on the understanding that the benefit-to-cost ratio would be at least 20<sup>19</sup>, the implementation of these programmes must be cost-effective and deliver maximum value for money, through efficient management of risks, optimum procurements and maximum synergies.

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19 "The Case for the Eumetsat Polar System (EPS)/Metop Second-Generation Programme: Cost Benefit Analysis" - Hallegatte, Stéphane (et al.) in "Yearbook on Space Policy 2011/2012: Space in Times of Financial Crisis" (Editors: Al-Ekabi, C., Baranes, B., Hulsroj, P., Lahcen, A.)

### International and global partnerships

The future development of EUMETSAT will involve global, multi-lateral and bilateral cooperation to leverage further benefits to Member States and users through data exchange – with the objective to better fulfil the requirements of the WMO, as foreseen by its Convention.

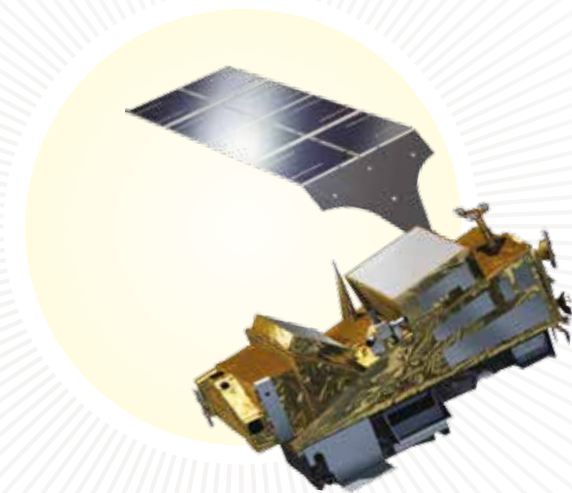
The definition of the "WMO Vision for the Global Observing System in 2040" will set the target for the future space-based component of the WMO Integrated Global Observing System (WIGOS) and will create the overall framework for multi-lateral and bilateral cooperation within the Coordination Group for Meteorological Satellites (CGMS) over the next decade. The WMO Commission for Basic Systems (CBS) will also remain an important forum for planning and coordinating observing systems, including the space component.

The planned contributions of the private sector to the delivery of meteorological observations from space could also be of interest to the WMO and EUMETSAT, if they are sustainable and follow the WMO principles and practices for free data exchange across NMHSs.

On the climate agenda, the implementation of the Global Architecture for Climate Monitoring from Space, coordinated by the Joint Working Group on Climate established by CGMS and the Committee for Earth Observation Satellites (CEOS), will be the framework for EUMETSAT's contribution to the "monitoring and observations" pillar of the Global Framework for Climate Services (GFCS) established in 2009 at the 3<sup>rd</sup> World Climate Conference (WCC-3) as a UN-led initiative spearheaded by the WMO, as well as for the fulfilment of the requirements for climate observations elaborated by the Global Climate Observing System (GCOS).

CEOS will be the framework for addressing the need for space-based observations required to achieve the objectives of the Sendai Framework for Disaster Risk Reduction approved in 2015, and for the response of the space community to the strategic plan approved on 13 November, 2015, in Mexico City, by the Ministerial Summit of the intergovernmental Group for Earth Observation.

# Foundation and main thrust of the new strategy



This new strategy shall take due account of all of the above multi-facetted evolutions of the environment in which EUMETSAT operates, whilst capitalising on the results achieved in the implementation of the previous strategy, (“EUMETSAT: a global operational satellite agency at the heart of Europe”), adopted in June, 2011.

While the previous strategy targeted the development of EUMETSAT as a global partner and the approval of new programmes required to secure the future of monitoring of weather and climate from space in Europe, this “Challenge 2025” strategy aims at further developing EUMETSAT through the realisation of its approved mandatory, optional and third party programmes (MTG, EPS-SG, Jason-CS, Sentinel-3, Copernicus), for the benefit of its Member States and of the EU.

Indeed, the main strategic goal for 2025 is the full and successful implementation of the new MTG, EPS-SG, Sentinel-3, Sentinel-4, Sentinel-5 and Jason-CS/Sentinel-6 missions, based on a smooth transition from the current generation systems, so that the continuity and expansion of services delivered to Member States and users is secured for a further decade and beyond.

This new strategy will be implemented in the context of the EMI and selected European and global partnerships involving the WMO, EU, ESA and other national space agencies, together with a portfolio of bilateral cooperation agreements with international partners, considered as a strategic asset.







## The Vision

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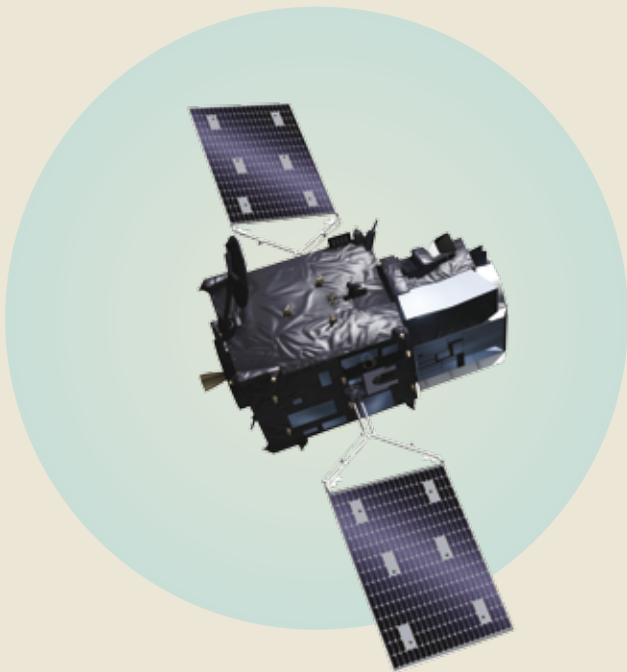
*“The vision of EUMETSAT is to be the leading user-driven operational agency in Europe for Earth observation satellite programmes that fulfil the objectives of its Convention, and a trusted global partner for those outside Europe who share these objectives.*

*“In realising this vision, EUMETSAT’s first priority shall be, through its own satellite programmes, to fulfil, in the most effective manner, the essential requirements of its Member States for observations and data services for operational weather and Earth system monitoring and forecasting, and for climate services.*

*“EUMETSAT’s second priority shall be to establish additional capabilities in partnership with the European Union and other satellite operators to achieve synergy with its own satellite missions for the common benefit of its Member States and partners.”*







# Policy Principles

EUMETSAT will implement this vision taking the following Policy Principles into account:

- 1 EUMETSAT, being an inter-governmental organisation, derives its main priorities from its Convention<sup>20</sup>;
- 2 EUMETSAT's activities shall be implemented in a manner that is affordable for its Member States and achieves best value for money and cost-effectiveness;
- 3 EUMETSAT, being user-driven, shall implement and continuously adapt its operational systems in response to evolving user requirements, for the benefit of its Member States;
- 4 EUMETSAT shall take the maximum advantage of science and technologies developed in its Member States to implement its programmes;
- 5 EUMETSAT shall continue to rely on ESA for the development of the space segment of its mandatory programmes;
- 6 EUMETSAT shall be an active partner of the European Meteorological Infrastructure with the aim of increasing its efficiency;
- 7 EUMETSAT shall consider supporting EU programmes that provide benefits to both its Member States and the EU as long as EUMETSAT's contributions to these programmes mobilise a proportionate share of its overall resources;
- 8 EUMETSAT shall make extensive use of international cooperation to increase efficiency, broaden and extend the benefits of its programmes;
- 9 EUMETSAT shall continue to contribute to the space component of the WIGOS.

20 <http://www.eumetsat.int/website/home/AboutUs/LegalInformation/BasicDocuments/index.html>

# Strategic objectives

- 1 *Deliver services responding to evolving user requirements, based on the continuous infusion of science and on cost-effective infrastructures and operations*
- 2 *Maximise the lifetime of the current satellite systems to ensure the best return on Member States' investments and a safe transition to the next generation systems*
- 3 *Plan, develop and implement the next generation of EUMETSAT satellite systems to deliver the maximum benefits to Member States*
- 4 *As a partner in the European Space Policy, establish and exploit EU Copernicus missions in synergy with EUMETSAT's missions, for the common benefit of EUMETSAT Member States and the EU*
- 5 *Meet additional needs of Member States through cooperation with other satellite operators*
- 6 *Expand the user base for EUMETSAT data, products and services in EUMETSAT Member States and among WMO Members*
- 7 *Contribute to global partnerships of relevance to monitoring of weather, climate and environment from space*
- 8 *Continuously improve management and risk management processes*
- 9 *Recruit and maintain a core resource of talented and engaged people with relevant skills*

## 1 *Deliver services responding to evolving user requirements, based on the continuous infusion of science and on cost-effective infrastructures and operations*

In fulfilling the objectives defined in its Convention, EUMETSAT will take advantage of the latest advances in remote sensing and algorithmic sciences and of new information technology, to respond to evolving user requirements for data, products and services in the most efficient manner.

### ***The EUMETSAT network of Satellite Application Facilities: a strategic asset***

EUMETSAT will maintain the networked architecture of its applications ground segment, involving central facilities in Darmstadt and eight SAFs distributed across its Member States, each specialised in one application area, in order to develop and deliver innovative environmental products that realise the full potential of space-based observations in the broadest possible range of existing and emerging applications. This allows the best use of infrastructure and resources available in Member States, capitalising on scientific expertise, close interactions with application experts and cross-network cooperation.

EUMETSAT's mandatory programmes shall accordingly provide sustained funding for the successive five-year Continuous Development and Operational Phases (CDOP) of all SAFs.

### ***Atmosphere, ocean, ice and land surfaces: a seamless portfolio of observational products***

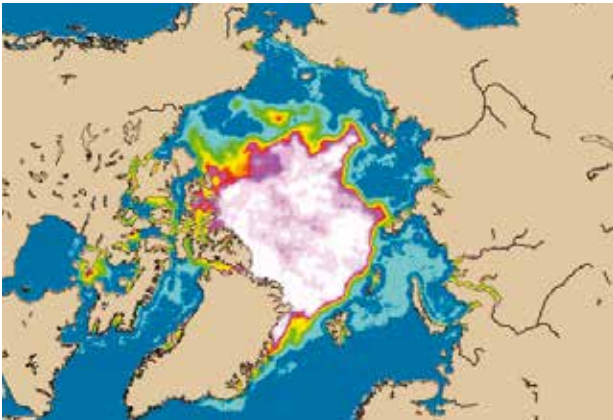
Considering the increasing integration of weather, marine and air quality forecast systems and services, covering local, regional and global scales and from short to extended ranges, one objective is to deliver a seamless portfolio of global, regional and local observational products of the atmosphere, the oceans, ice and land surfaces (including snow cover), and to derive climate data records from long time series of observations for climate applications.

This will be achieved based on the optimum combination of observations from the geostationary and low Earth orbits collected by EUMETSAT, joint and partners' satellite missions, and through the integration of products extracted at EUMETSAT's central facilities and across the network of specialised SAFs.

### ***Infusing science to deliver more and better observational products***

The infusion of the latest advances in remote sensing and algorithmic sciences into operational data processing chains implemented at EUMETSAT and across the network of SAFs will be the main driver of the evolution of EUMETSAT's product portfolio, in response to continuously evolving user requirements.

Sea ice concentration map in the arctic (source: OSI SAF)



For this purpose, scientific expertise will be maintained, developed and shared across EUMETSAT and its network of SAFs, as required to:

- Maintain an in-depth understanding of the use of satellite data in various applications and of related requirements and priorities for enhanced or new products, through structured interactions with NMHSs of Member States, Copernicus information service providers and user communities;
- Sustain interactions with the remote sensing research community, including through visiting scientists at EUMETSAT and SAF premises;
- Further develop methods for calibration of satellite data, using *in situ* observations as a reference when appropriate, in order to improve the quality of all downstream products;
- Implement agreed enhanced and new products across the EUMETSAT distributed ground segment, based on close cooperation between scientists and engineers;
- Validate enhanced and new products in cooperation with users.

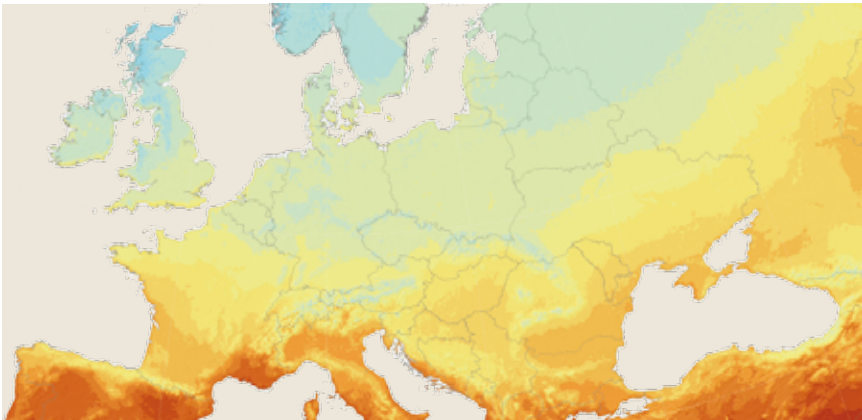
Cooperation with other satellite operators and international partners will also be continued to foster the exchange of knowledge and cross-fertilisation of ideas.

**Supporting Climate Services**

EUMETSAT already holds more than 35 years of data in its archive and is committed to extend existing climate records and initiate new ones in the next decades. This will be achieved with the approved MTG, EPS-SG and Jason-CS multi-satellite programmes and be based on the exploitation of Copernicus Sentinel missions on behalf of the EU.

This will support the NMHSs of Member States in their evolution into national weather and climate services in the context of the Global Framework for Climate Services (GFCS).

A map of photovoltaic solar electricity potential based on Meteosat solar irradiance climatology (source: JRC/CM SAF)



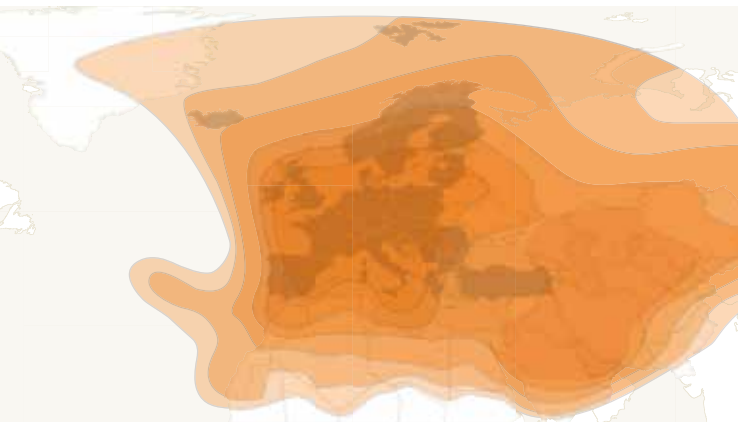
To achieve this objective, EUMETSAT will:

- Maintain a unique archive, spanning decades, of space-based observations of the atmosphere, ocean and land surfaces collected by missions exploited by EUMETSAT and partners;
- Produce consistent fundamental climate data records (FCDR) through re-calibration of space-based observations and reprocessing of associated long series of physical variables and thematic climate data records (TCDR) of geophysical essential climate variables (ECVs);
- Cooperate with the scientific community to validate climate data records (CDRs) and stimulate their use within the GFCS;
- Ensure easy access to a broad range of well-documented CDRs;
- Support the EU in the definition and implementation of its Copernicus Climate Change Service (C3S);
- Support climate-related capacity building initiatives, especially in Africa.

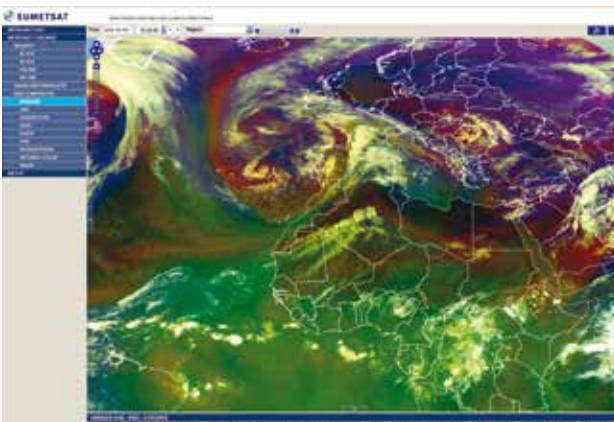
EUMETSAT’s support to climate services will be embedded in international initiatives led by the WMO, CGMS and CEOS and will make use of the infrastructure, resources and expertise available at its premises and across its network of SAFs, with the Climate Monitoring SAF (CM-SAF) playing a leading role.

To ensure sustained operations and contributions to selected cooperative research projects, funding of EUMETSAT’s climate-related activities will continue to be a balanced mix between EUMETSAT, Copernicus and other third-party funding sources (e.g. EU Horizon 2020 Research and Innovation Programme and follow up programmes).

EUMETSAT’s support to the C3S service will be agreed with the ECMWF and focus on re-calibration and reprocessing of data from satellites and instruments operated by EUMETSAT or available from partners.



*EUMETCast Europe coverage area (left) and display of Airmass RGB imagery, one of the most popular products of the EUMETView Web Map Service (right)*



**Improving data access**

EUMETSAT will continue to fulfil its very specific and challenging mission to deliver time-critical data and products to a user community scattered across several continents, with a committed level of end-to-end service, and to offer the easiest and cheapest access to data at the user end, in Member States, and in WMO Regional Associations RA-VI (Europe) and RA-I (Africa).

Acknowledging that the value of observations for forecasting diminishes with increasing latency, one key objective will remain achieving the shortest possible latency from sensing within affordable costs, which will be increasingly challenging with the more frequent (every 2.5 minutes) and more voluminous observations from MTG.

In the foreseeable future, this critical mission will be fulfilled through:

- The continuous improvement of the EUMETCast satellite-based data multi-casting service, using the most efficient digital video broadcasting (DVB) standards and optimising procurements and management of available bandwidth;
- Further enhancements of the EUMETSAT Advanced Retransmission Service (EARS) and introduction of an operational EPS-SG Regional Data Service, aimed at improving the latency of data from a constellation of three polar orbiting satellite systems operated by EUMETSAT, NOAA and CMA to 15-30 minutes from sensing, to facilitate their use for nowcasting and very short-range forecasting (VSRF).

EUMETCast will deliver an integrated real-time data stream including weather, atmospheric composition and marine products used for forecasting purposes, based on shared funding of bandwidth between EUMETSAT, the EU Copernicus Programme and EU-funded capacity building initiatives.

To the extent it fulfils requirements of its users, EUMETSAT will seek interconnection between EARS and similar WMO Direct Broadcast Network (DBNet) systems implemented by international partners.

For less time-critical and off-line data services, EUMETSAT will improve its on-line data access services and its archiving and retrieval facilities, in response to user needs and using new technologies.

In this area, the online EUMETSAT Earth Observation (EO) Portal will be enhanced to simplify user registration and improve key functionalities such as search, discovery, visualisation and retrieval of larger volumes of recently ingested and catalogued data. Interoperability with other EO portals will also be promoted, in particular in the context of Copernicus.

The EUMETSAT OGC-compatible<sup>21</sup> Web Map Services (WMS) will also be further developed, together with standard formats, to facilitate the use and overlaying of EUMETSAT products with other geo-referenced information.

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21 Open Geospatial Consortium





**Facing the “big data” challenge**

EUMETSAT will establish a roadmap of pathfinder projects for future data services, starting with an assessment of the relevance of cloud technology and other “big data” concepts and technologies for its wide spectrum of data access requirements, including time-critical data services as far as possible. This assessment will address performance, end-to-end service level commitment, flexibility, continuity of service, accessibility to a scattered user community, IT security, compliance with policy requirements, in particular data policy and procurement policy, and development and running costs. This assessment will also involve the SAF network.

Assessments of big data concepts and technologies will first address non time-critical data services and then be extrapolated to time-critical data services.

Whilst focussing on its specific requirements, EUMETSAT will consider similar plans and projects across the EMI, in the context of ESA activities and of the EU Copernicus programme, and will establish cooperation and coordination whenever appropriate and affordable. Lessons will also be learnt from similar initiatives by international partners, e.g. NOAA and other CGMS agencies.

**Continuity of service and cost-effectiveness will remain major drivers**

EUMETSAT will ensure that service continuity and cost effectiveness are embedded in its operations, and in the planning and implementation of all evolutions of its multi-mission ground systems and data services.

For the development and delivery of new products, a cost-effective balance will be sought between the contributions of EUMETSAT Central Facilities and the SAF network, along with the best possible quality of the products generated.



**2 Maximise the lifetime of the current satellite systems to ensure the best return on Member States’ investments and a safe transition to the next generation systems**

The next decade will see the operations of the last satellites of the current generation (MSG-4, Metop-C and Jason-3) and the transition to the next generation MTG, EPS-SG and Jason-CS/ Sentinel-6 systems in the 2020-2025 timeframe.

Considering the large uncertainties that still affect the development and deployment schedule of the new generation systems at this early stage of their development, EUMETSAT will maximise the useful lifetime of its current generation satellite systems in order to secure:

- A safe and seamless transition from the current to the next generation of satellite systems, with a sufficiently long overlap in orbit, and
- The continuity of core data services in case of a launch failure of the first satellites in the MTG-I, Metop-SGA and Metop-SGB series.

To achieve this, considering the increased risks related to the operation of ageing satellites, EUMETSAT will:

- Seek optimum workarounds to irrecoverable anomalies on ageing spacecraft to maximise their usable lifetime, and
- Strive to best exploit the residual capacities of ageing satellites to ensure maximum benefits to Member States and users.

The objectives in this regard will be to maintain dual Metop operations as long as possible and to extend Meteosat-8 operations at 41.5° East to provide “best efforts” support to the continuation of more resilient Indian Ocean Data Coverage (IODC) services after the de-orbiting of Meteosat-7, in a partnership also involving geostationary assets from India, China, Russia and Japan.

3 *Plan, develop and implement the next generation of EUMETSAT satellite systems to deliver the maximum benefits to Member States*

**Timely delivery of new generation satellite systems**

In the period 2011-2015, EUMETSAT Member States approved two mandatory programmes, MTG (2011) and EPS-SG (2015) and one optional programme, Jason-CS (2015), to secure the continuity of data services currently provided by the Meteosat Second Generation (MSG), EUMETSAT Polar System (EPS) and Jason-2/-3 systems, and further expand the scope and performance of these services in the next decades.

MTG will collect very frequent observations from the geostationary orbit to support nowcasting (NWC) and very short-range forecasting (VSRF) of high impact weather over Europe, Africa and adjacent seas, while EPS-SG will deliver global observations for short- to medium-range NWP.

Both satellite systems will contribute to the monitoring of ECVs from space and will include one Copernicus Sentinel sounding instrument to monitor atmospheric chemistry in synergy with EUMETSAT instruments.

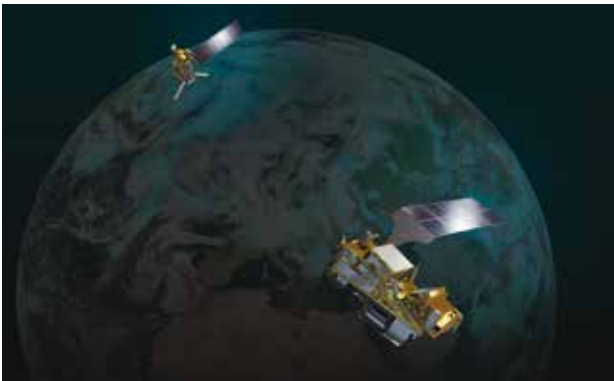
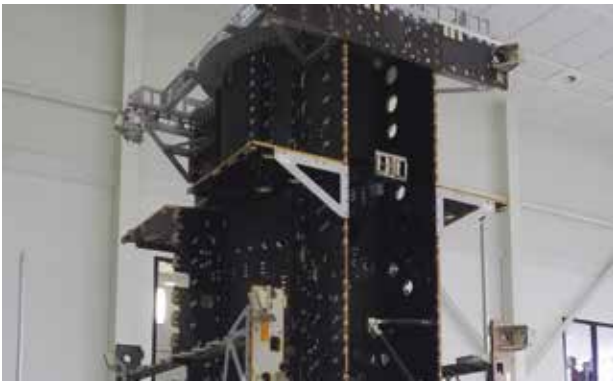
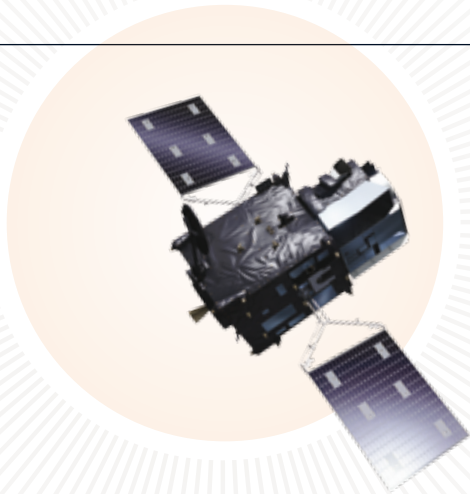
MTG will comprise two separate lines of geostationary satellites to be exploited simultaneously. The MTG-I (imaging) line will improve the current Meteosat imagery mission and add a lightning imaging capability, while the MTG-S (sounding) line will establish a world premiere hyper spectral infrared sounding (IRS) capability in geostationary orbit that delivers vertical profiles of temperature and moisture every 30 minutes over Europe. Combined together onboard the MTG-S spacecraft, the IRS and the Copernicus Sentinel-4 ultraviolet and near infrared (UVN) sounder will provide a unique, integrated capability to observe ozone, carbon monoxide, sulphur dioxide and other trace gases in support of air quality, pollution and climate monitoring.

The EPS-SG system will also involve two distinct lines of Metop-SG satellites to be exploited simultaneously, Metop-SGA and Metop-SGB. Metop-SGA will be an atmospheric sounding and imaging satellite embarking a suite of infrared and microwave instruments sounding temperature, moisture and trace gases in the atmosphere, complemented by the Copernicus Sentinel-5 ultraviolet near- and short-wave infrared sounder and by two visible/infrared imagers. Metop-SGB will be a microwave imagery mission, delivering radar observations of ocean-surface wind and soil moisture and all-weather imagery of precipitation. Both satellites will be equipped with a GNSS radio-occultation instrument for high vertical resolution limb soundings of temperature and moisture.

One strategic objective of the next decade will be to establish the MTG and EPS-SG satellite systems through the realisation of these approved programmes, namely:

- The successful completion of the development of both systems in cooperation with ESA and other development partners;
- Their timely deployment, to secure service continuity with current generation satellites (Meteosat-11 and Metop-C), including a sufficiently long transition period before their end of useful lifetime, currently foreseen around 2025.

Establishing the MTG and EPS-SG satellite systems, involving EUMETSAT, ESA, other development partner agencies and industry, is extremely challenging as both systems are of unprecedented complexity and in their early development phases, with large uncertainties remaining on the development schedules. Moreover, because both systems involve for the first time two different types of satellites to be launched 18 months apart, EUMETSAT needs to develop, integrate, test and commission two successive versions of the ground segments and end-to-end systems, mobilising large teams over more than five years.





This will require continuous assessment of development activities, management of risks, control of schedules, performance and costs in close interactions with partners, together with the optimisation of EUMETSAT resources throughout the overall development cycle.

The “Day 1” environmental products of both systems will be developed through an optimal distribution of tasks between the EUMETSAT central facilities and relevant SAFs.

Likewise, another objective in the period 2016-2022 will be to establish the Jason-CS system through the realisation of the Jason-CS programme, which is EUMETSAT’s contribution to the cooperative Jason-CS/Sentinel-6 high-precision ocean altimetry mission developed and implemented in partnership with ESA, the EU (through Copernicus) and the US through NASA and NOAA. EUMETSAT will coordinate system activities across partners, including operations preparation, develop the full ground segment and exploit the European part of the system on behalf of the EU.

The Jason-CS/Sentinel-6 mission will be implemented by two successive, identical Jason-CS satellites with the first, to be launched in 2020 with a five-and-a-half-year design lifetime, securing continuity and in-orbit cross-calibration with Jason-3. The primary mission objective is to support operational oceanography and marine meteorology, extended-range weather forecasting and climate services through the monitoring of mean sea level and other ocean parameters.

While ensuring that the best possible science is used to prepare for the use of the new generations of satellites, EUMETSAT will continue to invest in its central facilities and in SAFs to secure the continuous improvements of the products generated from the current generation of satellites.



***Planning the optimum deployment of recurrent MTG and Metop-SG satellites***

After the initial deployment of the full in-orbit operational capacity for MTG (two MTG-I satellites and one MTG-S satellite) and EPS-SG (one Metop-SGA and one Metop-SGB satellite), the objectives will be to maximise the benefits of both programmes to Member States through:

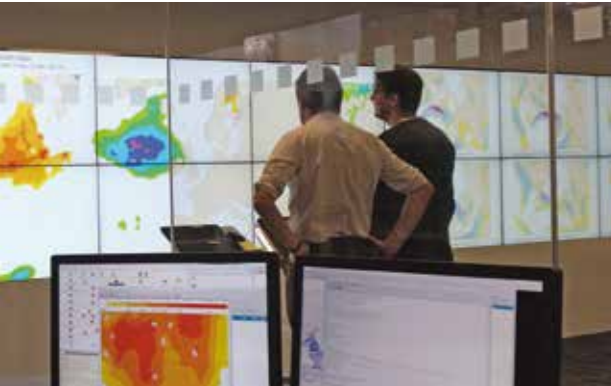
- Assessment of their impact on NWC, very short- to medium-range forecasting and other applications, in cooperation with the other constituents of the EMI and the providers of Copernicus information services;
- Deployment of “Day 2” products in cooperation with the network of SAFs and Copernicus;
- Optimum planning of the deployment of the recurrent satellites to assure continuity of services and inter-calibration across successive satellites;
- Maximising the lifetime of all in-orbit satellites.

***Planning for future programmes***

As an operational agency, EUMETSAT must, in due course, plan the future satellite systems required to further improve observational inputs to forecasting and climate monitoring in the 2040-2060 timeframe.

Although the preparation of new mandatory programmes is not foreseen before 2025, EUMETSAT will keep a suitable framework and tools (database) for maintaining and reviewing user requirements and priorities, taking into account WMO Rolling Requirements Reviews and lessons learnt from the continuous assessment of the impact of MTG, EPS-SG and third party missions’ data on applications by the user communities.

Considering the design lifetime of the two Jason-CS satellites, EUMETSAT will have to prepare for its contribution to the follow-on of the high-precision ocean altimetry missions in the 2020 timeframe, in the context of studies on the future of ocean altimetry involving Copernicus and US partners. This should continue to be implemented as a cooperative programme also involving ESA, the EU through its Copernicus programme, and the United States through NASA and NOAA. The Council will have to decide on the most suitable type of programme for EUMETSAT’s contribution to this mission, considering both affordability and the critical need for continuity of sustained observations of the global ocean for weather and climate services for the benefits for all Member States.



Innovative research missions developed by research and development (R&D) agencies as possible precursors of future operational missions will also be assessed, in particular ESA Earth Explorer missions like AEOLUS, targeting lidar-based measurements of vertical profiles of (line of sight) wind, or SMOS for the observation of soil moisture and ocean surface salinity. The rationale for the transition to operational status will be evaluated on a case-by-case basis, considering user priorities, enhancement and technology development required to fulfil operational requirements, lifecycle costs, and partnership and co-funding opportunities.

Likewise, EUMETSAT will cooperate with ESA, other development agencies and international partners for assessing the maturity of new technologies and concepts (e.g. miniaturisation of sensors, cubesats, hosted payloads, etc.) including those implemented by the private sector, and their capability to efficiently fulfil some requirements of Member States.

For planning and preparing future programmes, the objective will be to maintain a set of technology-independent satellite observational requirements for EUMETSAT programmes that fulfil the needs of EUMETSAT's users.

This will be achieved through a sustained dialogue with the NMHSs and other user entities of Member States, the ECMWF and providers of Copernicus information services. This dialogue will focus on observational requirements of nowcasting, very short- to extended-range forecasting and climate services, including cooperative impact assessment



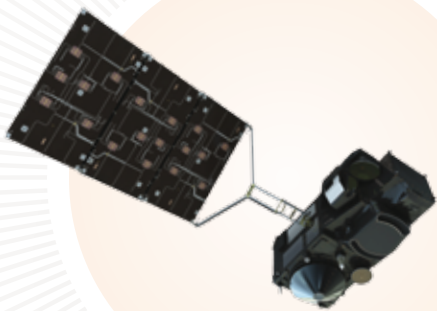
studies with the ECMWF, other numerical prediction centres and international partners. In addition, requirements for other applications, in particular ocean and air quality forecasting, will be addressed with NMHSs and Copernicus service providers. Requirements for observations of space weather will also be considered based on the experience available in Member States and at NOAA, taking into account opportunities within a possible EU SSA initiative and the capabilities of relevant Satellite Application Facilities.

Ultimately, EUMETSAT will prepare the user consultation process that needs to be initiated with ESA in the 2025-2027 timeframe as the first formal step in the planning of the Meteosat Fourth Generation (M4G) and the EPS-Third Generation (EPS-TG) programmes. This user consultation process will consider firstly how user requirements can be optimally fulfilled through an appropriate balance between observations from geostationary and low Earth orbits, based on an assessment of remote sensing techniques that are, or may be, capable of delivering relevant observations.

When planning the M4G and EPS-TG development programmes with ESA, EUMETSAT will consider the requirements for service continuity with respect to the MTG and EPS-SG systems, and as far as possible, how to de-phase both developments to avoid an unaffordable peak or plateau of overall contributions.

ESA will remain the development and procurement agency of choice for the space segment of the EUMETSAT mandatory programmes based on the proven cooperation model which has made Europe a world leader in satellite meteorology, making best use of respective competencies. Under this model, ESA is responsible for the development of satellites, fulfilling user and system requirements defined by EUMETSAT, and for the procurement of recurrent satellites on EUMETSAT's behalf. EUMETSAT develops the ground systems required to deliver products and services to users and to respond to their evolving needs, procures all launch services and operates the full system for the benefit of users. This does not preclude the establishment of bilateral arrangements with other space agencies for specific developments or activities.





- 4** *As a partner in the European Space Policy, establish and exploit EU Copernicus missions in synergy with EUMETSAT's missions, for the common benefit of EUMETSAT Member States and the EU*

**EUMETSAT's role in the European Space Policy**

As an operational user-governed agency, EUMETSAT brings to Europe a unique, resilient capability to deliver global observations, data and user support services around the clock, based on the combination of scientific and engineering skills and experience of day-to-day interactions with multiple user communities.

Consequently, since 2014, EUMETSAT has played a key role in the operations phase of the EU Copernicus Programme, delivering satellite data and information services, as part of the space component of Copernicus. EUMETSAT has made available to the EU its unique infrastructure, expertise, operational experience, as well as data from its own and partners' missions.

The objective of EUMETSAT, as a public entity, will continue to be ensuring the most efficient implementation of Copernicus in the next decade, in synergy with its own missions, and to create the broadest possible range of opportunities to users and providers of downstream services, in a business-neutral approach.

As this essential role of European public operational agencies was not identified in the European Space Policy established in 2007, EUMETSAT will work with European institutions (EC, EU Council and European Parliament) to ensure that it is recognised in a forthcoming EU Space Strategy.

As regards Copernicus governance, and its future development, the objective of EUMETSAT is to maintain a direct relationship with the EU.

Although Copernicus is expected to be the main area of cooperation with the EU, EUMETSAT will consider opportunities in other EU space initiatives, e.g. in relation to space situational awareness, including space weather.

EUMETSAT will also continue to support the Commission in the Space Dialogues established with non-European countries, in particular with the US, Japan, China, Russia and South Africa. EUMETSAT will work with its cooperation partners in each country, to inform the Dialogues of the relevance and mutual benefits of their bilateral cooperation, in particular in the context of Copernicus.



**Delivering and planning contributions to Copernicus**

In the 2015-2021 period, the priority will be the realisation of the EUMETSAT Third Party Programme implementing the Copernicus Agreement signed with the EU on 7 November 2014.

- EUMETSAT will perform all tasks entrusted by the EU, including:
- Operations and exploitation of the Sentinel-3 and Jason-3 missions in cooperation with ESA and NOAA, delivery of operational data and support services to the CMEMS, and preparation for the operations of the Jason-CS/Sentinel-6 cooperative mission;
  - Preparation for operations of the Sentinel-4 and Sentinel-5 atmospheric missions implemented as part of the EUMETSAT MTG and EPS-SG systems;
  - Dissemination and delivery of selected data and products from EUMETSAT's own and partners' missions (building on operational cooperation with the US, China, India, Japan, Korea, etc.) to both the CMEMS and the CAMS service providers and their users;
  - Supporting the technical implementation of data exchange arrangements established by the European Commission with third-party countries or groups of countries.

This will be achieved based on the maximum synergy with EUMETSAT's own missions and data services, with the objective of delivering integrated, multi-mission data streams and services that create the broadest possible range of opportunities and benefits to all users in EU and EUMETSAT Member States.

EUMETSAT will maintain sustained operational interactions with both the CMEMS and the CAMS service providers, to collect feedback on its data services, inform future EUMETSAT data services, capture evolutions of their requirements and consider possible responses - e.g. through studies, development of enhanced or new products or additional third-party data services - and coordinate user training activities.

EUMETSAT will coordinate with the CMEMS, CAMS and C3S Copernicus service providers and relevant SAFs to plan and achieve the best possible synergy between the EU-funded contributions of SAF entities to Copernicus services and the activities funded by EUMETSAT under the SAF Continuous Development and Operations Phases. This will be important to avoid unnecessary duplication or overlap whilst facilitating interfaces and interactions.



*Argulhas current modelisation (source: CMEMS/Mercator Océan)*

Whilst promoting the use of its own products by the CMEMS, CAMS and C3S service providers, EUMETSAT will make sure that the ownership of such products is acknowledged, and will establish arrangements as necessary for their authorised re-distribution in compliance with EUMETSAT’s data policy.

After assessing the technical and operational implications on its own ground systems and operations, EUMETSAT will contribute to the implementation of the roadmap for an Integrated Copernicus Ground Segment established by the European Commission, assuming the development is funded from the EU Copernicus budgets and consistent with EUMETSAT’s roadmap of pathfinder projects on future data services. EUMETSAT will, in particular, consider the joint development of cloud-based thematic platforms with providers of Copernicus information services and relevant SAFs.

EUMETSAT will also prepare the continuation of the current Copernicus Agreement with the EU into the next MFF (2021–2027), with a view to negotiating a subsequent agreement with the EU in a timeframe enabling seamless continuity of critical tasks including:

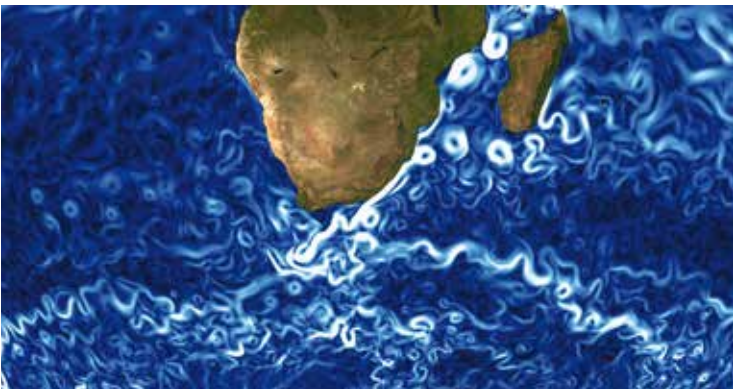
- The continuity of Sentinel-3 and Jason-3 operations;
- The continuity of all data services delivered by EUMETSAT on behalf of the EU;
- The preparation for the operations of the Sentinel-4 and Sentinel-5 missions implemented as part of EUMETSAT’s MTG and EPS-SG systems and the cooperative Jason-CS/Sentinel-6 mission;
- Any additional activity agreed in the course of the implementation of the current Copernicus Agreement, or required to implement decisions made on the evolution of the Copernicus ground segment and on the next generation of Sentinel missions.

**Planning for additional and next generation Sentinel missions**

In the discussions on the design and development of additional and next generation Sentinel missions, EUMETSAT will remain focussed on those missions that are relevant to its Convention, create synergies with its own missions and deliver benefits to EUMETSAT and EU Member States.

It is expected that discussions will first focus on potential additional missions (e.g. monitoring of atmospheric CO<sub>2</sub>/CH<sub>4</sub>, fast polar imagery mission from highly elliptic orbit, polar ice and soil moisture and salinity monitoring based on the Cryosat and SMOS heritage) that should be exploited in synergy with EPS-SG, MTG and Sentinel-3, -4, -5 and -6 operated by EUMETSAT, based on the selection of optimum orbits, in particular for missions based on narrow swath instruments.

Discussions will also be required in the medium term on the next Sentinel marine missions, considering the design lifetime of the Sentinel-3 and Jason-CS satellites.



In line with the Copernicus Agreement signed with the EU, EUMETSAT might, at the request of the European Commission and subject to additional funding, support the requirement definition process for such Sentinel missions, preferably in cooperation with ESA.

In any case, EUMETSAT will assess, in cooperation with ESA, the implications of these additional and next generation Sentinel missions on its multi-mission infrastructure and make sure that its possible roles in development and operations will involve a proportionate fraction of its resources.

In principle, EUMETSAT will seek responsibility for operations of these Sentinel missions on behalf of the EU, making maximum reuse of its multi-mission ground infrastructure and of its specific expertise and know-how. EUMETSAT will also seek involvement in the development of the ground segment and end-to-end system in cooperation with ESA, as necessary to ensure a safe transition to operations by EUMETSAT.

The model for the involvement of EUMETSAT will need to be assessed on a case-by-case basis, depending on the mission proposed, its implementation and EUMETSAT’s heritage, but should include cooperation with ESA in the development phase and a third-party programme funded by the EU for the operations phase.

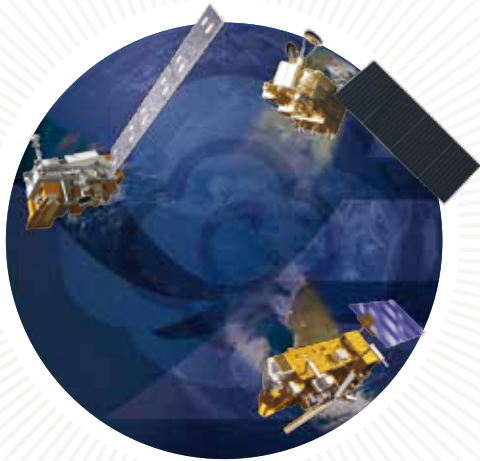
Whilst third-party programmes should remain the main legal basis, appropriate funding mechanisms should be envisaged for EUMETSAT to secure the integrity, control and ownership of systems also used for its own missions.

Contributions to the development phase through a EUMETSAT programme will be considered in the case of the continuity of cooperative missions like Jason-CS/Sentinel-6 or for missions proposed for implementation as part of EUMETSAT’s future satellite systems, like Sentinel-4 or Sentinel-5, flown on EUMETSAT MTG and Metop-SG satellites. In such cases, EUMETSAT will make sure that user requirements established by the EU are supported by its own user community, its funded contributions are recognised, and that the additional mission cannot be a driver for the development and operations of EUMETSAT’s own systems.

*Alain Ratier, Director-General of EUMETSAT and Stephen Volz, NOAA Assistant Administrator, signed the JPS Agreement during the 84<sup>th</sup> session of the EUMETSAT Council*



*Observations from mid-morning, afternoon and early-morning polar orbits from Metop, JPSS (NOAA) and FY-3E (CMA) satellites*



**5** *Meet additional needs of Member States through cooperation with other satellite operators*

As no single country can, on its own, provide sufficiently global and frequent observational coverage from space, international cooperation among satellite operators is the most efficient vehicle for integrating or coordinating respective space assets and sharing data for mutual benefit.

Over the next decade, EUMETSAT will maintain and consolidate a consistent portfolio of bilateral cooperation agreements with other satellite operators, considered as a strategic asset, and consider cooperation with new partners as opportunities arise.

In general, bilateral cooperation will continue to be imbedded in the context of global partnerships, in particular with the WMO Space Programme, CGMS and CEOS, to establish a comprehensive global space-based observing system that fulfils the requirements of the worldwide user community.

EUMETSAT will continue to cooperate with other satellite operators, based on the principle of reciprocity, to acquire additional data fulfilling the requirements of its Member States and broaden its user-base outside its Member States.

The synergy between orbits, missions or instruments will remain an important criterion for bilateral cooperation to achieve overall improved capacity, coverage and sampling. EUMETSAT will therefore support coordinated planning with international partners to promote their development of highly capable instruments comparable to those to be flown on its Metop-SG and MTG satellites.

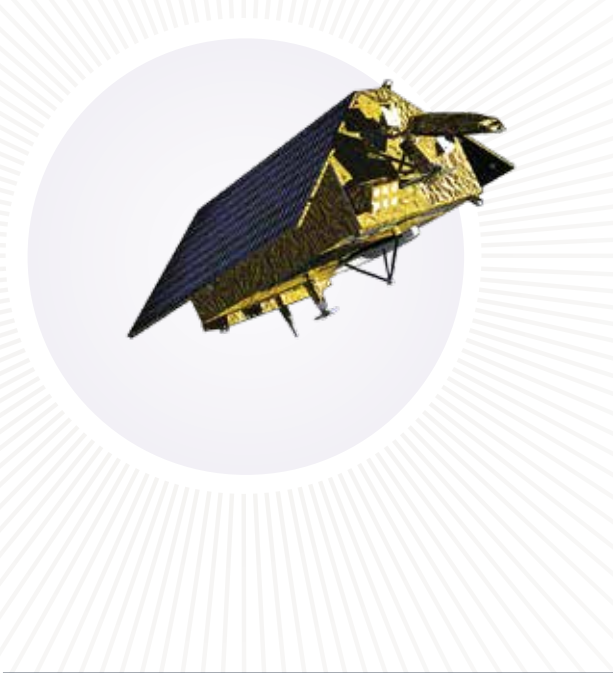
The cooperation with the United States, firmly established through the Long-Term Cooperation Agreement signed with NOAA in 2013, will continue to involve the sharing of satellite systems in low Earth orbits. In the next decade, the Initial Joint Polar System will be followed by the Joint Polar System, whereby EUMETSAT will continue to provide observational coverage from the mid-morning orbit with its EPS-SG programme while the NOAA Joint Polar Satellite System (JPSS) programme will cover the afternoon orbit. Likewise, EUMETSAT

will continue to share operations of the Jason-3 and Jason-CS/Sentinel-6 high-precision ocean altimetry missions with NOAA and NASA.

EUMETSAT will also expand its cooperation with NASA to the development and implementation of the collaborative Jason-CS/Sentinel-6 mission in cooperation with ESA and NOAA, in a scheme comparable to Jason-2/-3 and involving the EU in the operations phase. Thus Europe and the United States will together secure the continuation of high-precision ocean surface topography and mean sea level measurements and establish a fully operational capability in this area.

In the area of risk management, NOAA and EUMETSAT will maintain a back-up geostationary agreement for imaging missions, whereby one spare satellite can be moved over the Atlantic to mitigate the total loss of capacity by one partner, and will reinforce their cooperation on conjunction warnings and space collision avoidance to protect their shared in-orbit assets.

Under the enhanced agreement signed in 2013 with China's Meteorological Administration (CMA), the cooperation will address coordination of assets in polar and geostationary orbits, scientific cooperation and exchange of data with cross-dissemination to the respective user communities. Substantial additional benefits will accrue in the next decade, following the decision of CMA to launch one FY-3 polar orbit satellite to the unpopulated early morning orbit in order to realise the "WMO Vision for the Global Observing System (GOS) 2025" and its plan to launch an advanced geostationary FY-4 satellite equipped with a hyper spectral infrared sounder, like MTG-S. The cooperation with China's State Ocean Administration (SOA) will also continue on the acquisition, sharing and processing of ocean satellite data.



Well-established cooperation will also further develop over the next decade with India, Japan, Russia and Korea, as EUMETSAT partner agencies have recently deployed or plan to deploy new generations of geostationary and low Earth orbit operational meteorological satellites. With these partners, EUMETSAT will cooperate on science, data acquisition, exchange and processing to deliver cost-efficient third party data services to its users and make its own data available to users outside Europe.

Considering the increasing importance of the Arctic region for weather forecasting over Europe and for the understanding of climate change, the seamless combination of frequent observations of polar latitudes from Highly Elliptical Earth Orbits (HEO) with Meteosat imagery of lower latitudes represents a major opportunity. EUMETSAT therefore plans to expand its cooperation with Environment Canada in the context of their assessment of options to support polar weather and environment monitoring services from a Highly Elliptical Orbit. One objective would be to share Meteosat data processing algorithms and software to achieve the best possible consistency of products from the equator to the poles. A similar approach could be developed for the Russian Arktika constellation of satellites dedicated to the monitoring of the Arctic.

Considering that a number of research missions delivering data in near-real time has proven useful for weather forecasting, climate and environmental monitoring, EUMETSAT will pursue cooperation with R&D agencies (e.g. CNES, DLR, ESA, ISRO, JAXA, NASA,...), in particular when relevant products can be made available in real time to EUMETSAT users at low cost.

Finally, EUMETSAT will assess how space weather data and forecasts from international partners could be made available to the NMHSs of its Member States to meet their increasing demand for such information, considering also that EUMETSAT can be a customer of space weather forecasts for the protection of its in-orbit assets.

**6** *Expand the user base for EUMETSAT data, products and services in EUMETSAT Member States and among WMO Members*

**EUMETSAT Membership**

EUMETSAT now has 30 Member States and one Cooperating State - expected to become a full Member State by 2017.

Further accessions to EUMETSAT's Convention will continue to focus on Member States of the EU and countries having established formal relationships with the EU through an on-going accession process.

For other countries, specific project-based arrangements will be considered, with the support of the WMO.

An evolution of the status of Cooperating State may be considered in due course, taking due account of the impact on the governance of EUMETSAT and the experience gained by other organisations.

**Data Policy**

The WMO Resolutions and the Oslo Declaration<sup>22</sup>, endorsed by all constituents of the EMI, will remain the references for the evolution of EUMETSAT's data policy, in support of the extension of its user base. Therefore, when developing the data policies for MTG and EPS-SG, EUMETSAT will offer more and better products and services free-of-charge in order to share the benefits of more capable systems with all users and to encourage the maximum use of its data in combination with Copernicus data.

EUMETSAT will also consider the GEO data sharing principles and the promotion of full, free and open data policy in Europe, the requirements of the directive on the re-use of public sector information (PSI-directive) and of the directive on the European Spatial Data Infrastructure (INSPIRE), together with the impact of the emergence of commercial providers of meteorological observations from space on data exchange within the WMO.

Full and non-discriminatory access will continue to be offered to the worldwide user community under well-documented licensing conditions, and the exchange of hydrological, meteorological and climate data will be supported in accordance with WMO Resolutions 25, 40 and 60.

<sup>22</sup> <http://www.eumetsat.int/website/home/AboutUs/LegalInformation/DataPolicy/index.html?lang=EN>





**Training and User Preparedness**

In order to realise the full return on the strategic investments of its Member States in advanced satellite systems, EUMETSAT will continue to be active in the provision of training and support to capacity-building initiatives.

EUMETSAT's contribution to training will remain part of an integrated cooperative effort, mobilising expertise and resources across partners, in particular within the EMI through EUMETCAL, the training co-operation programme between the national meteorological and hydrological services (NMHS) in Europe. This involves an international network of experts on satellite products, applications and techniques for using satellite data, across the network of SAFs, the NMHSs and the relevant WMO programmes, including the Virtual Laboratory (VLab).

The first priority of EUMETSAT-funded training activities will be to ensure that personnel of NMHSs maintain and develop the necessary skills to understand and exploit current satellite data in their forecasting, research and climate monitoring activities, and then gain the necessary knowledge for the up-take of innovative data from the next generation MTG, EPS-SG and Jason-CS/Sentinel-6 missions. A special focus will be to ensure that more and more satellite data are assimilated by NMHS and NWP consortia.

EUMETSAT will support NMHSs of its Member States to achieve preparedness for the use of data from MTG and EPS-SG, through the delivery of relevant proxy and test data, and dedicated initiatives aimed at coordinating their respective preparedness projects and sharing best practices and lessons learnt.

Within the resources available, EUMETSAT will strive to extend the user base in Member States beyond the meteorological user community and to provide training to users in WMO RA-VI (Europe) and RA-I (Africa), in the context of capacity building initiatives funded by third parties.

As part of its Third Party Copernicus programme, EUMETSAT will also support user training in relation to the Copernicus Sentinel-3, -4, -5 and -6 missions operated by EUMETSAT on behalf of the EU, in cooperation with the providers of the Copernicus CMEMS, CAMS and C3S information services. Considering the synergy between EUMETSAT and Copernicus missions and the overlap of their targeted applications, synergies will be sought in training activities to take the best advantage of available human resources and funding available from EUMETSAT and the EU.

EUMETSAT will also continue to support scientific cooperation aimed at reinforcing the science base on the user side, through its Research Fellowship and Visiting Scientist programmes, and sustained interactions with the user community, in particular through its annual Satellite User Conferences and Copernicus events.

**Capacity Building**

EUMETSAT will support the Operational Plans of the WMO RA-VI (Europe) and RA-I (Africa), without excluding cooperation with other Regional Associations. The objective will be to help the meteorological communities to get easier access to, and make best use of, EUMETSAT data, products and services to help individual countries and regions to meet their respective needs.

In RA-VI (Europe) and neighbouring countries, EUMETSAT will capitalise on the assets of the Data Access for Western Balkan and Eastern European and Caucasian Countries (DAWBEE)<sup>23</sup> and Satellite Data access for Central Asia (SADCA) projects to support access and use of its data. This will facilitate the development of national or regional projects coordinated by the WMO and responding to weather-related EU policy priorities in the region, e.g. Disaster Risk Reduction and implementation of the EU Directive on the assessment and management of flood risks<sup>24</sup>. These activities could be supported by EU financial instruments such as the Instrument for Pre-Accession Assistance (IPA-2) and the European Neighbourhood Instrument.

In RA-I (Africa), EUMETSAT will act within the framework of its Memorandum of Understanding with the African Union Commission and work with the European Commission to secure a follow-up initiative to the highly successful Preparation for the Use of Meteosat in Africa (PUMA), African Monitoring of Environment for Sustainable Development (AMESD) and Monitoring of Environment and Security in Africa (MESA) programmes supported by the European Development Fund.

It will also support other projects funded by new EU instruments, including the Regional Retransmission Services in Africa (RARS-Africa) project aimed at establishing a regional NWP capability in Africa. EUMETSAT will also continue to follow the implementation of the Joint Africa-EU Strategy (JAES) and the implementation of GFCS in Africa.

In planning for future initiatives in Africa with the EU, EUMETSAT will consider the impact of high volumes of data generated by new EUMETSAT and Copernicus missions, taking into account the user priorities established through the WMO RA-I Data Expert Group (RAIDEG).

23 Data Access for Western Balkan and Eastern European and Caucasian Countries  
24 2007/60/EC



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**7** *Contribute to global partnerships of relevance to monitoring of weather, climate and environment from space*

All Member States of EUMETSAT are also Member States of the World Meteorological Organization, which is the United Nations' System's authoritative voice on Weather, Climate and Water, and the EUMETSAT Convention foresees that the organisation shall take into account, as far as possible, the requirements of the WMO.

Therefore, the WMO, in particular the WMO Integrated Global Observing System (WIGOS) and its Space Programme, and the WMO Information System (WIS), will continue to be the general international framework within which EUMETSAT activities are embedded and articulated with those of other operators of meteorological satellites.

Considering its close links with WMO programmes, the CGMS will continue to be the forum for developing multi-lateral coordination and cooperation across meteorological satellite operators. Over the next decade, EUMETSAT will remain the Permanent Secretary and an active member of CGMS to promote multi-lateral cooperation aimed at coordinating satellite systems from an end-to-end perspective, including protection of in-orbit assets, improvement of the quality of data and support to users, as required to facilitate shared access and develop the use of satellite products in various applications.

One short-term objective within CGMS will be the continuation of more resilient Indian Ocean Data Coverage services after the de-orbiting of Meteosat-7 in May 2017, through the combination of multi-partner assets from India, China, Russia and extended operations of EUMETSAT's Meteosat-8 at 41.5° East, on a "best efforts" basis.

EUMETSAT will also support the definition of the "WMO Vision for the Global Observing System in 2040" setting the target for the future space-based component of the WIGOS and contribute to its implementation through its approved MTG, EPS-SG and Jason-CS programmes.



As a major provider of satellite data and products, the organisation will also contribute to the WIS, through its various data access systems and services.

EUMETSAT will contribute to the “monitoring and observation” pillar of the GFCS, through the joint Working Group on Climate tasked by the CGMS and the CEOS to coordinate the implementation of the “Global Architecture for Climate Monitoring from Space”.

Also in relation to the GFCS, EUMETSAT will continue to support the Global Climate Observing System (GCOS), the Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) initiative and the Global Space-based Inter Calibration System (GSICS), with the support of its network of SAFs.

The organisation will also maintain sustained interactions with the World Climate Research Programme (WCRP) to promote the best possible use of its Climate Data Records in climate research and of its satellites in the definition of dedicated observation strategies.

In addition to its role in the joint CGMS-CEOS Working Group on Climate, EUMETSAT will be active in the CEOS partnership through its involvement in the working groups and virtual constellations focused on ocean and atmosphere monitoring, where global coordination creates opportunities and tangible benefits from the combination of missions from operational and research agencies.

EUMETSAT’s participation in other global partnerships will be selective and focused on activities creating added-value to its main missions and benefits to its Member States. Within the intergovernmental Group on Earth Observations (GEO), EUMETSAT will support selected activities including the GEONETCast global data broadcast system and other data access systems established with NOAA and CMA.



## 8 *Continuously improve management and risk management processes*

### **Management**

Over the next five years, EUMETSAT plans to maintain and consolidate the full matrix organisation established in 2013 to make more flexible use of its human resources across operations and development programmes and to face the challenge of operating more satellite systems from 2016 onwards.

In the context of the growth of the organisation, the emphasis will remain on the continuous improvement of processes and procedures – including simplification wherever possible – to ensure that EUMETSAT manages its activities and resources in a safe, responsive and cost-effective manner.

One objective will be to achieve compliance of the Quality Management System (QMS) against the new 2015 version of the ISO 9001 standard and possible future evolutions, considering additional standards, if appropriate.

The EUMETSAT procurement process will remain driven by the objective of best value for money, through full open competition whenever practicable, but with a clear preference for European industrial solutions, where the capabilities exist and European solutions are competitive. Notwithstanding the European preference, EUMETSAT needs to keep flexibility in deciding on its procurements of launch services and to probe the market.

EUMETSAT procurement procedures will remain, as far as possible, compliant with the EU rules on public procurements, and will be reviewed on a regular basis to further increase efficiency and transparency based on lessons learnt and best practices.

As regards financial processes, EUMETSAT will continue to improve its budgeting and financial planning processes, to provide full visibility to Member States whilst taking into account the uncertainties inherent to the development of systems of unprecedented complexity like MTG and EPS-SG. EUMETSAT will continue to follow international accounting standards, in particular the International Public Sector Accounting Standards (IPSAS), and simplify as far as possible the presentation of financial information to Member States for better readability and easier assessment.

The human resource management processes will continue to be modernised based on the generalisation of the concept of “HR Business Partnering” introduced in 2014, whereby one human resource specialist provides end-to-end support to a department, and the human resource planning process will be streamlined.

The suitability of the Enterprise Resource Planning (ERP) tool and its current implementation for business and control requirements will be reassessed taking into account the outcome of relevant audits, and evolutions will be considered if needed and affordable.

EUMETSAT will maintain its headquarters facilities in a cost-effective manner taking into account the coexistence of ageing and new buildings, safety and security requirements, standards applicable in Germany and the objective of minimising carbon emissions.

A roadmap will be developed for the evolution of the internal IT services to maintain the level of service required by a modern organisation whilst containing costs, based on the introduction of new standard IT solutions and competitive procurements.

EUMETSAT will continuously adapt its external communication to reflect progress in the implementation of its strategy and evolutions of the external environment, whilst remaining an authoritative European voice on monitoring weather and climate from space. One objective will be to convey to decision makers and the general public the image of a scientific, high technology, cost-effective operational organisation that brings value to society and worldwide users within a complex value-adding chain involving the NMHSs of its Member States, the ECMWF and Copernicus service providers. For this purpose, EUMETSAT will use a variety of communication channels including social media.

**Risk Management**

Risks are inherent to both core missions of EUMETSAT, i.e. the operational exploitation of complex satellite systems and the conduct of the challenging development of new systems in cooperation with ESA and other partners.

Risk management will therefore remain part and parcel of all its activities and processes, particularly as large investments from Member States are involved and continuity of data services is critical for the protection of life and property and for the economy.



Over the next decade, EUMETSAT will continue to develop its risk management system based on relevant standards, addressing, in particular, operational, development and financial risks and protection of tangible and intangible assets, including regular reassessment of external threats and vulnerability.

The approach to risks will remain proportionate, considering likelihood and severity, and the affordability of mitigation actions.

In the operations area, the processing of anomalies will remain a priority to minimise impacts on services to users, and the continuity of core data services will remain an objective even in case of disaster at EUMETSAT headquarters.

The protection of operational assets will address IT and cyber security, data preservation and avoidance of collision with space objects through SSA services available from European and US sources. EUMETSAT will coordinate with the WMO, Member States and other space agencies for the protection of vital frequencies in the context of the International Telecommunication Union (ITU).

As regards mitigation of space debris, EUMETSAT will optimise the end-of-life scenarios of its current Metop satellites to allow uncontrolled re-entry within 25 years and will make sure that relevant regulations are followed for the design and development of its future satellites.

EUMETSAT will continue to protect its intellectual property and the ownership of data and assets through relevant licensing arrangements and clauses in contracts and agreements.

Development risks will be identified and managed using state-of-the-art methods and best practices throughout the development cycle of the MTG, EPS-SG and Jason-CS systems.

As regards financial risks, the internal control framework will be based on the principle of the three lines of defence, involving line management, the Director-General and the Council, and a mix of *a priori* and *a posteriori* controls evolving towards more *a posteriori* controls by internal audits.





**9** *Recruit and maintain a core resource of talented and engaged people with relevant skills*

A vital strategic asset of EUMETSAT is its people, and the strength and depth of their skills and know-how in all competence areas that are necessary to fulfil the organisation's commitments to its Member States.

In order to ensure that highly qualified people remain available in-house in the next decade and beyond, during the long lifecycle of its challenging MTG and EPS-SG programmes, EUMETSAT will implement the long-term human resource strategy endorsed by its Council in 2014.

The main objectives are to:

- Respond to the ageing of the population of EUMETSAT engineers and scientists - a general feature in the space sector - through the recruitment of high-potential early career professionals who will start and develop their career at EUMETSAT;
- Recognise the role of senior experts in the development of less experienced staff, and
- Reinforce the attractiveness of EUMETSAT in the recruitment and retention of the highly experienced technical and science managers required to manage a broader portfolio of programmes and projects.

The impact of the implementation of this strategy will be assessed on a regular basis, every four to five years, based on a set of indicators also addressing control of the evolution of staff costs.

Whilst continuing to apply the principle of open competition for the recruitment of the best possible candidates, EUMETSAT will seek to offer career opportunities and facilitate internal mobility for existing qualified employees by offering a perspective of managerial or expert career routes.

Training for staff will be conducted in a planned and prioritised way to ensure the availability of the skills needed for the future, as identified by innovative skills assessment processes, and to prepare staff for current and future roles. The Competence Areas established in the Technical and Scientific Support Department to create critical masses will provide a suitable environment for on-the-job development for less experienced staff, including mentoring of those recruited under an Early Career Employee Programme.

EUMETSAT will also facilitate interactions with young scientists from NMHSs or academia of Member States, e.g. through visiting scientists and fellowship schemes.

As a member of the Coordinated Organisations, EUMETSAT will maintain remuneration and pension benefits as appropriate to ensure that recruitment and retention needs are met, whilst at the same time ensuring that non-remuneration aspects of benefits and working conditions remain modern and relevant and are brought to the attention of potential applicants.

EUMETSAT will remain committed to maintaining excellent employee relations through the use of a variety of communication and feedback mechanisms, and through an open and constructive partnership with the Staff Association Committee (SAC). This will include improvement of internal communication and Staff surveys every four to five years, aimed at measuring staff engagement, with the objective of maintaining it at the highest possible level above external benchmarks, in a decade where the workload will significantly increase.

# Glossary

## of terms and acronyms

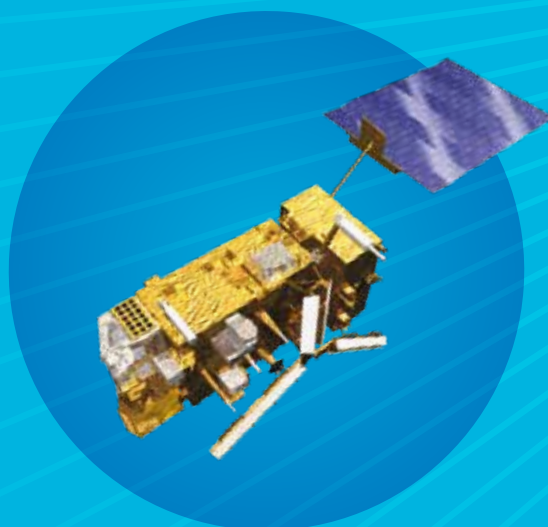
<b>AMESD</b>	African Monitoring of Environment for Sustainable Development	<b>ECV</b>	essential climate variables
<b>CAMS</b>	Copernicus Atmosphere Monitoring Service	<b>ECMWF</b>	European Centre for Medium-Range Weather Forecasts
<b>CBS</b>	Commission for Basic Systems	<b>EMI</b>	European Meteorological Infrastructure
<b>CDOP</b>	Continuous Development and Operations Phase	<b>E0</b>	Earth observation
<b>CDR</b>	climate data records	<b>EPS-SG</b>	EUMETSAT Polar System Second Generation
<b>CEOS</b>	Committee on Earth Observation Satellites	<b>EU</b>	European Union
<b>CGMS</b>	Coordination Group for Meteorological Satellites	<b>EUMETNET</b>	European Meteorological Network
<b>CH<sub>4</sub></b>	methane	<b>EUMETSAT</b>	European organisation for the Exploitation of Meteorological Satellites
<b>CMA</b>	China Meteorological Administration	<b>ERP</b>	Enterprise Resource Planning
<b>CMEMS</b>	Copernicus Marine Environment Monitoring Service	<b>ESA</b>	European Space Agency
<b>CM SAF</b>	SAF on Climate Monitoring	<b>FCDR</b>	fundamental climate data records
<b>CO<sub>2</sub></b>	carbon dioxide	<b>GCOS</b>	Global Climate Observing System
<b>C3S</b>	Copernicus Climate Change Service	<b>GDP</b>	gross domestic products
<b>DAWBEE</b>	Data Access for Western Balkan, Eastern European and Caucasian Countries	<b>GEO</b>	Group on Earth Observations
<b>DBNet</b>	Direct Broadcast Network	<b>GFCS</b>	Global Framework for Climate Services
<b>DG CONNECT</b>	European Commission Directorate General for Communications Networks, Content and Technology	<b>GOS</b>	Global Observing System
<b>DG GROW</b>	European Commission Directorate General for Internal Market, Industry, Entrepreneurship and SMEs	<b>GSICS</b>	Global Space-based Inter-Calibration System
<b>DLR</b>	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Centre)	<b>HEO</b>	Highly Elliptical Earth Orbits
<b>DVB</b>	digital video broadcasting	<b>IASI-NG</b>	Infrared Atmospheric Sounding Interferometer - Next Generation
<b>EARS</b>	EUMETSAT Advanced Retransmission Service	<b>INSPIRE</b>	Infrastructure for Spatial Information in Europe
		<b>IODC</b>	Indian Ocean Data Coverage
		<b>IPA-2</b>	Instrument for Pre-Accession Assistance
		<b>IPCC</b>	Intergovernmental Panel on Climate Change



<b>IPSAS</b>	International Public Sector Accounting Standards	<b>R&amp;D agencies</b>	research and development agencies
<b>IRS</b>	infrared sounding	<b>SAC</b>	Staff Association Committee
<b>ISO</b>	International Organization for Standardization	<b>SADCA</b>	Satellite Data access for Central Asia
<b>ISRO</b>	Indian Space Research Organisation	<b>SAFs</b>	satellite application facilities
<b>ITU</b>	International Telecommunication Union	<b>SCOPE-CM</b>	Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring
<b>JAES</b>	Joint Africa-EU Strategy	<b>SSA</b>	space situational awareness
<b>JAXA</b>	Japan Aerospace Exploration Agency	<b>SOA</b>	State Ocean Administration
<b>JPSS</b>	Joint Polar Satellite System	<b>RAIDEG</b>	WMO RA-I Dissemination Expert Group
<b>LEO</b>	low Earth orbit	<b>RARS-Africa</b>	Regional Advanced Retransmission Service in Africa
<b>MEO</b>	medium Earth orbit	<b>TCDR</b>	thematic climate data records
<b>MESA</b>	Monitoring of Environment and Security in Africa	<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>MFF</b>	Multi-annual Financial Framework	<b>UVN</b>	ultraviolet and near infrared
<b>MTG</b>	Meteosat Third Generation	<b>VLab</b>	WMO Virtual Laboratory
<b>MTG-S/IRS</b>	Meteosat Third Generation Infrared Sounder	<b>VSRF</b>	very short-range forecasts
<b>NASA</b>	National Aeronautics and Space Administration	<b>WCC-3</b>	World Climate Conference-3
<b>NMHSs</b>	National Meteorological and Hydrological Services	<b>WCRP</b>	World Climate Research Programme
<b>NOAA</b>	National Oceanic and Atmospheric Administration	<b>WIGOS</b>	World Meteorological Organization Integrated Global Observing System
<b>NWC</b>	nowcasting	<b>WIS</b>	WMO Information System
<b>NWP</b>	numerical weather prediction	<b>WMS</b>	web map service
<b>OGC</b>	Open Geospatial Consortium	<b>WMO</b>	World Meteorological Organization
<b>PSI</b>	Public sector information	<b>WMO RA-I</b>	WMO Regional Association I (Africa)
<b>PUMA</b>	Preparation for the Use of Meteosat in Africa	<b>WMO RA-VI</b>	WMO Regional Association VI (Europe)
<b>QMS</b>	quality management system		







**30**  
**YEARS**  
1986-2016

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© EUMETSAT, September 2016  
EUM COR.02  
ISSN 1029-0664  
ISBN 978-92-9110-102-3