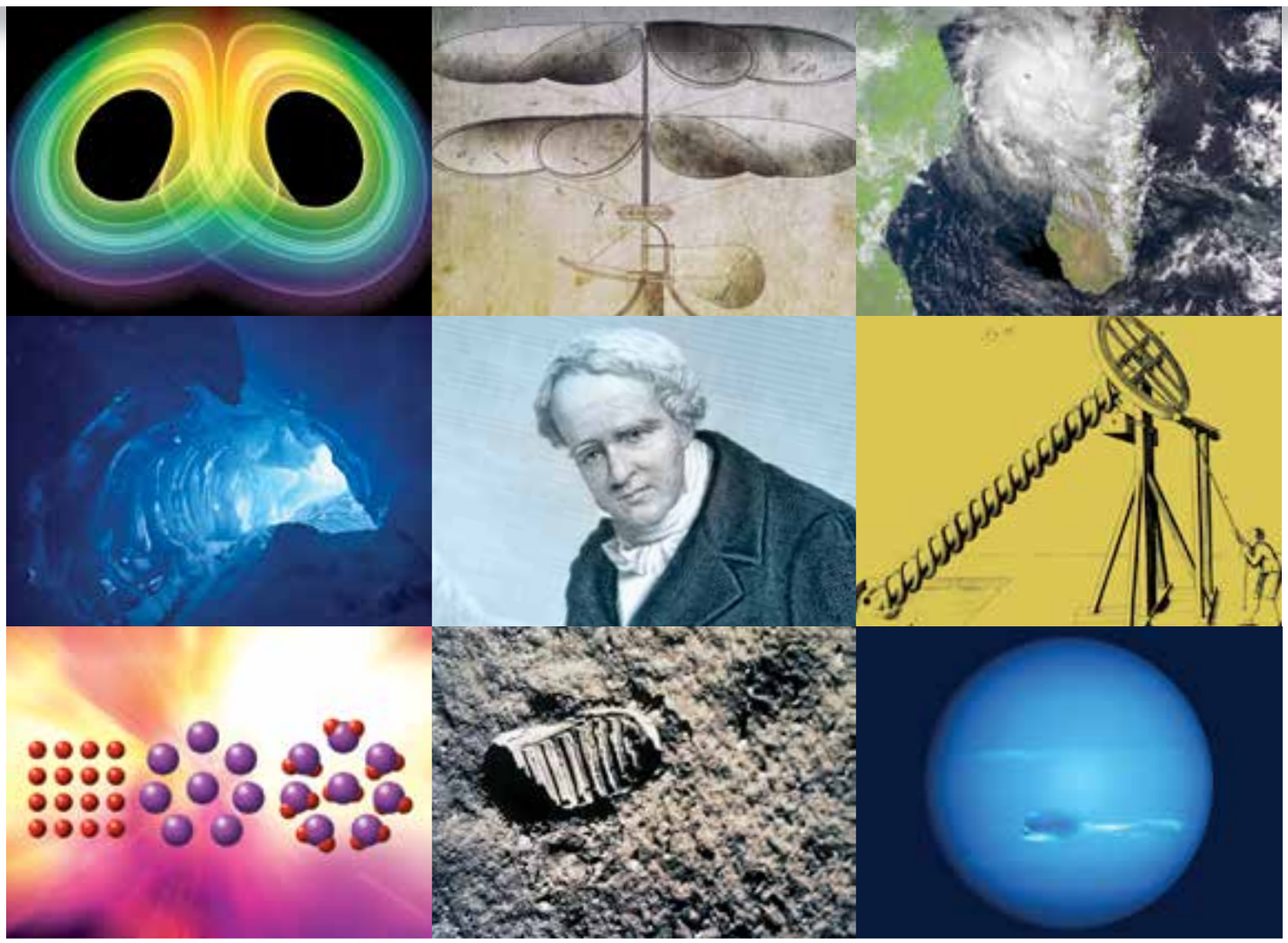
EUMETSAT

ANNUAL REPORT **2013**



LUXEMBOURG

Gabriel Lippmann
16 August 1845 - 13 July 1921

Awarded the 1908 Nobel Prize for Physics for his method of reproducing colours photographically, Lippmann contributed to many branches of physics. He invented the coelostat, which allowed long-exposure photographs of the sky so stars could be photographed without apparent movement. He also developed a highly sensitive capillary electrometer, used in the first ECG machine.

NETHERLANDS

Christophorus H. D. Buys Ballot
10 October 1817 - 3 February 1890

Buys Ballot is best known for the law named after him. This states that, in the Northern Hemisphere, when a person stands with his back to the wind, the low atmospheric pressure will be to his left. Buys Ballot strove to organise the observation and collection of meteorological data and founded the Netherlands Meteorological Institute.

LITHUANIA

Marcin Odlanicki Poczobutt
30 October 1728 - 7 February 1810

Astronomer, mathematician and professor at Vilnius University for over 50 years, Poczobutt contributed to astronomy, meteorology and education, as well as refinements to cartography. From 1770, he systematically measured and recorded weather temperature in Lithuania, with continuous records since 1777 surviving. The moon's Poczobutt crater is named in his honour.

NORWAY

Roald Amundsen
16 July 1872 - c. 18 June 1928

Polar explorer who led the first expedition to reach the South Pole on 14 December 1911. Amundsen became the first person to reach both poles and the first to traverse both the Northeast and Northwest passages. He died in a plane crash in the Arctic while on a mission to rescue fellow explorer Umberto Nobile.

LATVIA

Friedrich Zander
23 August 1887 - 28 March 1933

Engineer Zander was a pioneer of rocketry and aviation. He designed the first liquid-fuelled rocket launched in the Soviet Union. He was the first person to suggest using the Earth's atmosphere to enable a spacecraft to brake and to grow plants in greenhouses on board. At the same time, he continued his research into developing jet engine design.

SLOVENIA

Herman Potočnik
22 December 1892 - 27 August 1929

Writing under the pseudonym Hermann Noordung, rocket engineer and pioneer of cosmonautics Potočnik's book, "The Problem of Space Travel" proposed solutions enabling humans to live in outer space. He proposed geostationary satellites, detailed a design for a space station and described using orbiting spacecraft for detailed observation of the Earth.

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SPAIN

José María Algué
c. 29 December 1856 - 27 May 1930

Roman Catholic priest and astronomer, Algué became director of the Manila Observatory in 1879, during a time of turmoil in the Philippines. He invented the barocyclonometer, an instrument that allowed sailors to determine the location and direction of storms, a type of nephoscope, which measures the alititude, direction and velocity of clouds, and a microseismograph.

SLOVAK REPUBLIC

Ján Bahýľ
25 May 1856 - 13 March 1916

Inventor and engineer best known for developing a helicopter with an internal combustion engine, which Bahýľ flew himself in 1905. He also invented a hot air balloon combined with an air turbine for which he was granted a patent. He is considered probably Slovakia's greatest inventor.

BULGARIA

Vladimir Damgov
22 November 1947 - 20 June 2006

A physicist and mathematician, Damgov is recognised for his contributions to the application of chaos theory to mechanical and radiophysical systems and to space exploration and space studies. He was a professor at the Space Research Institute of the Bulgarian Academy of Sciences and has numerous patents and publications to his name.

GREECE

Archimedes of Syracuse
c. 287 BC - c. 212 BC

Archimedes was a mathematician and inventor who determined that the volume of a sphere is two-thirds that of the smallest cylinder that can contain it. He also formulated the law of the lever and the principle of buoyancy. The "Archimedes Screw" – a revolving spiral inside an open-ended cylinder – allows water to be raised from one level to another.

GERMANY

Alexander von Humboldt
14 September 1769 - 6 May 1859

Von Humboldt was an explorer and naturalist who is considered a founder of modern geography. After a journey in Russia, he encouraged the establishment of weather observatories there, data from which he was able to use to develop the principle of continentality. He also developed the first isotherm map, which contains lines of equal average temperatures.

ROMANIA

Emil Racovită
15 November 1868 - 17 November 1947

Speleologist (cave explorer), zoologist, biologist, explorer and promoter of natural sciences in Romania, Racovită was the first biologist to study arctic life. In 1897 he took part in an international expedition to Antarctica which was also the first to take hourly meteorological readings and measurements for a year. He is considered a founder of biospeleology.

FRANCE

Urbain Le Verrier
11 March 1811 - 23 September 1877

Le Verrier was an astronomer and mathematician who predicted the existence of the planet Neptune by mathematical means. He also constructed tables of the movements of the sun, moon and planets, and published works on periodic comets. His name is one of the 72 engraved on the Eiffel Tower.

TURKEY

Ismail Akbay
17 October 1930 - 27 July 2003

Heralded in his homeland as the "Turkish villager who helped put man on the moon", Akbay worked for NASA for more than 30 years. He was involved in the Apollo, Apollo-Soyuz and Skylab projects. Akbay also helped set up Space Camp Turkey, which opened in 2000 and teaches children and young people about astronomy and science.

UNITED KINGDOM

John Dalton
6 September 1766 - 27 July 1844

Chemist, meteorologist and physicist Dalton established a cornerstone of modern chemistry through his atomic theory, which grew out of his interest in meteorology, atmospheric observations and study of gases. His study of the absorption of gases in liquids included his law of partial pressures, now known as Dalton's Law.

Footprint on the moon © NASA

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THE WORD OF THE DIRECTOR-GENERAL

The year 2013 was certainly a landmark in the history of EUMETSAT, considering that the organisation gained two more Member States, Estonia and Lithuania, and signed accession agreements with Iceland and Bulgaria, who both joined in 2014.

Alain Ratier
Director-General

This undoubtedly demonstrates the trust placed in the organisation, but also, in the context of the economic crisis, the fact that the Meteosat Third Generation (MTG) and EUMETSAT Polar System Second Generation (EPS-SG) satellite systems being established in cooperation with ESA to deliver observations in the 2020-40 timeframe are worth the new cycle of strategic investments starting now.

The development of these new systems mobilised the efforts of the entire organisation in 2013. A major milestone was passed in the challenging MTG development programme with the authorisation to start the detailed design phase after the successful system preliminary design review. In parallel, the requirements for EPS-SG were reviewed on time for the delivery of critical inputs for the ESA invitation to tender for the development of the Metop-SG satellites, and all possible efforts were made to contain the costs of the mandatory EPS-SG programme to be proposed to Member States by mid-2014.

Trust and mutual benefits were also the key words attached to the signature of new cooperation agreements with international partners. The long-term agreement with NOAA provides the policy framework for the expansion of our strategic cooperation with the USA, including the future Joint Polar System and the continuation of the high precision ocean altimetry missions beyond Jason-3. Cooperation with the China Meteorological Administration also took a strategic dimension, with a new agreement addressing not only data exchange and science, but also coordination of the respective polar-orbiting and geostationary satellites, as part of the optimisation of the WMO Integrated Global Observing System.

In the same vein, the European Commission confirmed its intention to establish a Copernicus delegation agreement with EUMETSAT, covering among other things, operations of the Sentinel-3 and Jason-3 marine missions on behalf of the European Union. In this perspective, while the integration of the Sentinel-3 ground segment at our headquarters progressed in cooperation with ESA, the EUMETSAT Council unanimously adopted a resolution preparing a third-party programme providing the legal framework for EUMETSAT's support of the EU Copernicus programme.

Thus, more than ever, EUMETSAT is a trusted global partner, in line with the strategy approved by its Council in 2011. This was further illustrated by our taking over the annual chairmanship of the Committee for Earth Observation Satellites in November 2013.

From an operational viewpoint, 2013 was a consolidation year after the successful launches of Meteosat-10 and Metop-B in 2012, with EUMETSAT now operating seven satellites in three different orbits.

Dual operations of the new Metop-B and the ageing Metop-A satellites offered additional measurable benefits to Member States and users, through the delivery of two parallel real-time data streams to Numerical Weather Prediction models and the new possibility to infer global wind vectors from the displacement of clouds observed by overlapping images taken 48 minutes apart by both satellites.

After a series of complex manoeuvres - performed without any service interruption - relocating the three Meteosat satellites to their nominal orbital slots, the availability of all data services was established at the highest possible level, using Meteosat-10 for the Full Earth Scan service, Meteosat-9 for the Rapid Scan Service over Europe and Meteosat-8 as a hot back-up for both services. This could be achieved as a result of the successful mitigation of the slow degradation of the thermal balance of the ageing Meteosat-8 and Metosat-9 satellites by specific operations procedures, and the optimum use of Meteosat-8. The latter even allowed an increase in the availability of the Rapid Scan Service to users by 7% over the maximum level previously achievable with only two satellites in orbit. Unfortunately, this benefit was lost in December, after the mechanical collapse of the antenna acquiring data from Meteosat-8. On the positive side, this incident, which required the establishment of an inquiry board, provided the first opportunity to appreciate the measures implemented to continue to safely operate satellites and preserve continuity of core services even in case of disasters. Fortunately, there was no impact on users or on the safe control of Meteosat-8, which was taken over by back-up ground stations.

The development of new products restarted progressively at EUMETSAT headquarters after the release of scientists and engineers from the Metop-B and Meteosat-10 validation tasks. This was more than compensated for by the introduction of a large number of new products across the network of Satellite Application Facilities and of new third-party data services building on the cooperation established with NOAA and other satellite operators from China, India and Russia.

All these achievements required the greatest commitment from all EUMETSAT personnel and I wish to express my sincere gratitude to all of them, along with my personal thanks to the EUMETSAT Council and its advisory bodies for their guidance. This will be equally essential in a challenging year 2014, when the EPS-SG programme and the third-party programme covering EUMETSAT's support of Copernicus will be proposed for approval to Member States.

2013 HIGHLIGHTS

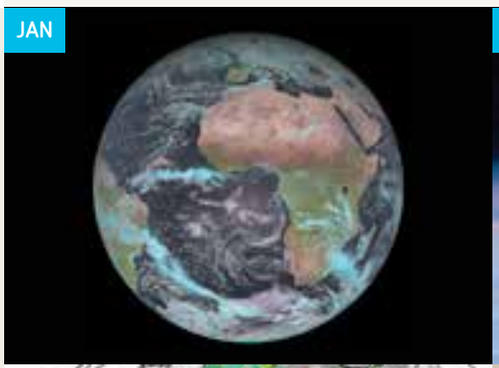
The accession of new Member States, the signature of new cooperation agreements with international partners and the preliminary definition of EUMETSAT's support to Copernicus with the European Commission confirmed EUMETSAT's position as a global trusted partner. Meanwhile, the preliminary design phase of the Meteosat Third Generation (MTG) system was completed, requirements for the EPS Second Generation (EPS-SG) programme were consolidated, and the new matrix organisation was implemented to meet future challenges.

JAN

Meteosat-10 takes over the Full Earth Scan service from 0° longitude from Meteosat-9

Metop-B is handed over to operations, following the successful acceptance and handover review

Kick-off of the EU-funded GMES-PURE (Partnership for User Requirements Evaluation) and CORE-CLIMAX projects



FEB

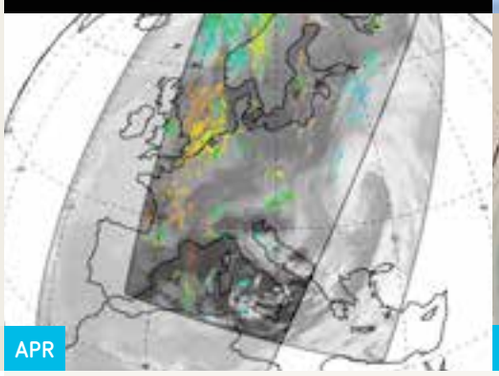
Signature of the MTG Lightning Imager contract by Thales Alenia Space and Selex ES

Release of the invitations to tender for the MTG ground stations

Successful conclusion of the Jason-3 System Interface Review involving NOAA, NASA, CNES and EUMETSAT

MAR

The EUMETCast data broadcasting service celebrates its 10th anniversary

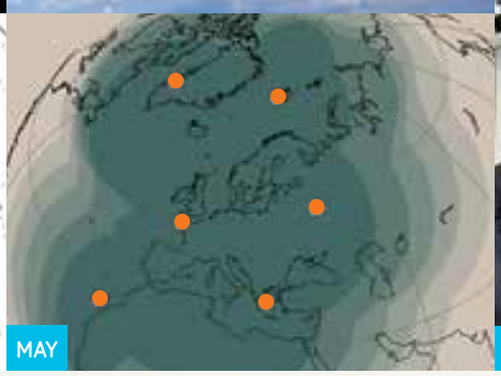


APR

Metop-B becomes the primary Metop satellite, and dual Metop operations begin

Meteosat-9 takes over the Rapid Scan Service from Meteosat-8

The first meeting of Jason-CS Potential Participating States endorses the satellite baseline for the ESA phase B2 study



MAY

The Advanced Retransmission Service regional data services for sounding products from the US Suomi NPP satellite become operational (EARS-CrIS and EARS-ATMS)

Meteosat-8 becomes the hot back-up satellite for both the Full Earth Scan service and the Rapid Scan Service, increasing the availability of the Rapid Scan Service to users by 7%

Meteosat-8 is used for the first of four "super rapid scan" experiments in support of research on convection

JUN

Completion of the MTG System Preliminary Design Review

Completion of the first part of the EPS-SG System Requirements Review and delivery of requirements to ESA

Signature of a new cooperation agreement with the China Meteorological Administration

Estonia becomes the 27th EUMETSAT Member State

The Forward 2020 reorganisation project is closed

Council approves the preliminary proposal for a third-party programme covering EUMETSAT's support to Copernicus

Council approves the continuation of the EUMETCast Americas service in 2014-2015

The timeliness of delivery of products from both Metop satellites and NOAA-19 is improved

Signature of a memorandum of understanding on cooperation on Earth observation with the African Union Commission and of an implementation arrangement for the Monitoring of Environment and Security in Africa (MESA) project

End of commissioning of Metop-B, after validation of all level 2 products

Signature of a Long-term Cooperation Agreement with NOAA

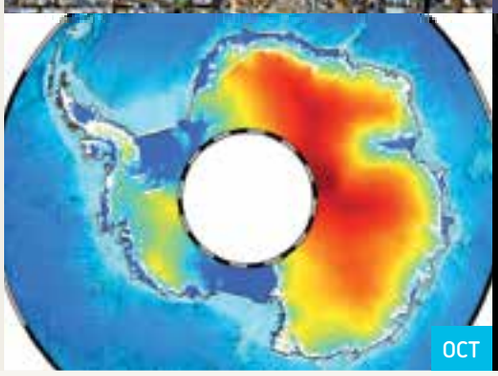
Lithuania completes its accession process and becomes the 28th Member State with effect from 1 January 2014

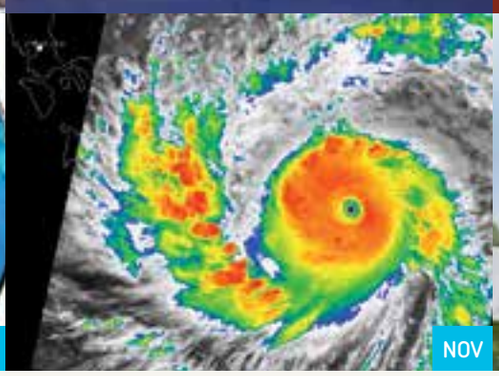
Signature of accession agreement with Iceland

Joint EUMETSAT/AMS Meteorological Satellite Conference in Vienna, Austria

Decision to postpone the launch of MSG-4 from February to summer 2015

ESA releases the invitation to tender for the development of the Metop Second Generation satellites and the procurement of recurrent units on behalf of EUMETSAT





The SARAL third-party data service becomes operational on EUMETCast

Start of the development of the Mission Operations Facility of the MTG ground segment

EUMETSAT's support to the Charter on Space and Disaster Management is operationally qualified

EUMETSAT takes over the annual chairmanship of the Committee on Earth Observation Satellites

Signature of the accession agreement with Bulgaria

Council endorses the draft end user requirements for the EPS-SG programme

An inquiry board is set up after the mechanical collapse of a Meteosat antenna in Usingen

Start of the development of the first version of the Image Data Processing Facility (IDPF-I) of the MTG ground segment

Extension of the Jason-2 mission until the end of 2017

Signature of the construction contract for the New Office Building

Release of the second announcement for the international symposium "Climate research and Earth observation from space: climate information for decision-making"

Signature of the grant agreement with the EC for the SNPP4 Copernicus project

Completion of the ratification process for Iceland's accession to the EUMETSAT Convention

The second meeting of Jason-CS Potential Participating States endorses the draft end user requirements

MEMBER AND COOPERATING STATES

As it entered a new cycle of challenging satellite development programmes, EUMETSAT gained two more Member States in 2013 - Estonia and Lithuania - and signed accession agreements with Iceland and Bulgaria.

In summer 2013, Estonia, Lithuania, Iceland and Bulgaria made decisive progress towards accession to the EUMETSAT Convention.

After parliamentary ratification of its accession agreement, Estonia became the 27th Member State on 21 June. It was followed by Lithuania, which became the 28th Member State on 1 January 2014, after completion of its accession process on 29 August.

On 30 August, in Reykjavik, the Director-General and Iceland's Minister for Environment and Natural Resources signed that country's accession agreement, which the Council had approved on 25 June. The ratification process was then completed in December.

On 19 August, the Bulgarian government notified its intention to accede to the EUMETSAT Convention, leading to the signature of the accession agreement with the Bulgarian Minister of Science and Education on 25 November, during the 79th session of Council. The parliamentary ratification process followed in 2014.

With these developments, EUMETSAT counted 28 Member States on 1 January 2014, and attained 30 during the year. Discussions will continue with Serbia, which is considering an extension of its Cooperating State Agreement before becoming the 31st Member State.

EUMETSAT celebrating accession of new Member States with Prof Dr Ene Ergma, President of the Estonian Parliament, Mr Gediminas Kazlauskas, Lithuanian Minister of the Environment, Prof Dr Aneliya Klisarova Bulgarian Minister of Education and Science and Mr Sigurður Ingi Jóhannsson, Icelandic Minister for the Environment and Natural Resources

EUMETSAT MEMBER AND COOPERATING STATES, 1 JANUARY 2014

MEMBER STATES

	SINCE
AUSTRIA	1993
BELGIUM	1986
CROATIA	2006
CZECH REPUBLIC	2010
DENMARK	1986
ESTONIA	2013
FINLAND	1986
FRANCE	1986
GERMANY	1986
GREECE	1986
HUNGARY	2008
IRELAND	1986
ITALY	1986
LATVIA	2009
LITHUANIA	2013
LUXEMBOURG	2002
NETHERLANDS	1986
NORWAY	1986
POLAND	2009
PORTUGAL	1986
ROMANIA	2010
SLOVAK REPUBLIC	2006
SLOVENIA	2008
SPAIN	1986
SWEDEN	1986
SWITZERLAND	1986
TURKEY	1986
UNITED KINGDOM	1986

COOPERATING STATES

	SINCE
BULGARIA	2005
ICELAND	2006
SERBIA	2009

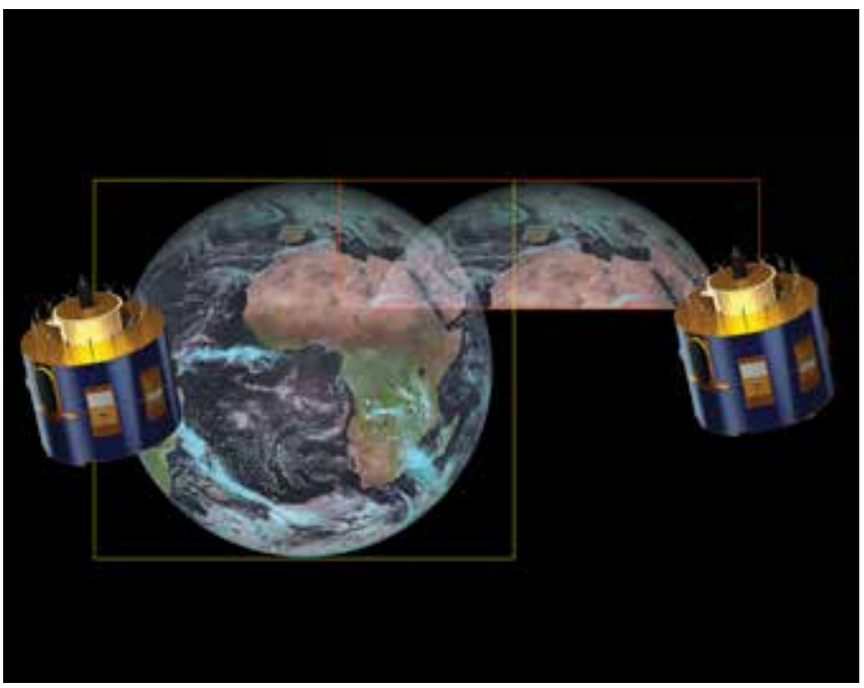
"The accession of Estonia and Lithuania and the conclusion of accession agreements with Iceland and Bulgaria were particularly rewarding for us in the legal service, also because it contributes to our strategic objective of extending the user base."

Mechtild Lauth
Acting Head of Legal Affairs
EUMETSAT

OPERATING COMPLEX SATELLITE SYSTEMS AROUND THE CLOCK

In 2013, EUMETSAT exploited seven operational satellites in three different orbits, delivering observations of the weather, atmospheric composition, ocean, land surfaces and our changing climate. Dual Metop operations and the optimum use of the Meteosat-8 back-up satellite improved the availability and scope of data services to users, bringing additional benefits to Member States.

Meteosat operated as a two-satellite system: Meteosat-10 (left) delivers full Earth imagery every 15 minutes, while Meteosat-9 (right) provides faster imagery (every five minutes) but only over Europe and adjacent seas. Meteosat-8 (not represented) serves as a hot back-up for both missions



FULL CONTINUITY OF METEOSAT SERVICES DESPITE A SERIES OF COMPLEX MANOEUVRES

Meteosat-7, the last first-generation Meteosat satellite, continued to deliver the Indian Ocean Data Coverage service from 57° East throughout 2013, bridging an important observation gap over the region.

After completion of the commissioning of Meteosat-10, the three Meteosat Second Generation (MSG) satellites underwent a series of complex manoeuvres. These aimed to establish the most reliable space segment configuration to support nowcasting of high impact weather in Europe and Africa, through the combination of the Full Earth Scan (FES) imagery service, available every 15 minutes, and Rapid Scan Service (RSS) available every five minutes but only over Europe and adjacent seas.

Meteosat-10 was relocated from 3.4° West to 0° longitude, taking over the FES service from Meteosat-9 on 21 January, and Meteosat-9 from 0° to 9.5° East to take over the RSS service from Meteosat-8 on 9 April. After one month of parallel operations confirming that the geometric quality of Meteosat-9 imagery was better than Meteosat-8 in all scanning modes, Meteosat-8 was moved to 3.5° E and became the hot back-up for both missions on 7 May. Full continuity of both services was ensured across the sequence of manoeuvres.

The planned penultimate Meteosat-9 inclination manoeuvre was performed on 28 May, while Meteosat-10 had to be moved on the same day to mitigate the risk of a collision with an old Russian satellite, predicted by the US Air Force Joint Space Operation Centre (JSpOC) warning service to approach within 700 metres of Meteosat-10.

The three MSG satellites then remained in their nominal positions for the rest of the year, with the Geostationary Earth Radiation Budget (GERB) mission conducted by the Meteosat-9 instrument after the blocking of the de-spin mirror of the instrument on board Meteosat-10 on 27 April.

USING THE METEOSAT-8 BACK-UP SATELLITE TO IMPROVE SERVICE AVAILABILITY

The back-up Meteosat-8 satellite was mainly used to improve the availability of the Full Earth Scan (FES) and Rapid Scan (RSS) services. It prevented an eight-day interruption of the FES service during the decontamination of the Meteosat-10 SEVIRI imaging instrument - from 1 to 9 July - and filled the 48-hour monthly gap in the Meteosat-9 RSS service that is required to preserve the lifetime of the SEVIRI instrument's scan mechanism.

At the request of the Convection Working Group, Meteosat-8 was also used in May, June and July for four 12-hour experiments of "super rapid scanning" (2.5-minute scan cycle) over part of Europe for meteorological situations selected in coordination with the European Severe Storm Laboratory. The imagery collected supports research on convective systems and will be used to simulate the fast imaging capabilities of future Meteosat Third Generation satellites.

DUAL METOP OPERATION IMPROVES THE ROBUSTNESS OF THE EPS MISSION AND DELIVERS TEMPORARY ADDITIONAL BENEFITS

In 2013, the EUMETSAT Polar System (EPS) exploited two Metop satellites from the sun-synchronous, mid-morning orbit as part of the Initial Joint Polar System (IJPS) shared with the United States to collect global, highly accurate observations of atmospheric, land and ocean parameters. These data are only accessible from low Earth orbit and are critical to short- to medium-range forecasts and nowcasting at polar latitudes.

The new Metop-B satellite replaced the ageing Metop-A as the primary Metop satellite on 24 April. However, Metop-A continued to provide the full set of instrument data, including full support to the ARGOS mission to compensate the partial loss of the Metop-B ARGOS capability due to an on-board antenna anomaly.

The two-satellite system was then exploited in the dual operations scenario approved by Council: both satellites flew on the same orbit, about half an orbit apart (48 minutes), with their GOME-2 (Global Ozone Monitoring Experiment) instruments operating in different configurations, i.e. with the nominal full swath (1,920 km width) and coarse spatial resolution on Metop-B and with a half swath (960 km) and higher spatial resolution on Metop-A.

As long as Metop-A can be maintained in its nominal orbit, the overall EPS mission will be more resilient to in-orbit anomalies or failure and will offer increased observational coverage and sampling based on two data streams. However, only Metop-B data can be dumped twice per orbit, both at Svalbard and McMurdo, and be processed and delivered to users with the best possible timeliness.

Out-of-plane manoeuvres were performed for Metop-A on 20 March and for the first time for Metop-B, on 6 November.

AVAILABILITY OF SATELLITE SYSTEMS

The new Metop-B and Meteosat-10 satellites brought availability of data services back to the highest level, while the ageing of Jason-2 became noticeable through several on-board anomalies.

METEOSAT SYSTEM

The availability of Meteosat satellite systems has been very high, including excellent geometric quality of imagery from all second generation satellites. For the ageing Meteosat-8 and Meteosat-9 satellites, this was achieved as a result of successful measures implemented on the ground to mitigate the impact of in-orbit degradation: image processing software corrected the impact of fuel migration aboard Meteosat-9, and ground-commanded thermal control of the fuel tanks reduced the amplitude of the Meteosat-8 wobble.

Only three significant service outages occurred in 2013. The first, on 18 August, was due to a ground segment anomaly impacting both the RSS and FES services delivered by Meteosat-9 and Meteosat-10. Two more outages of the RSS service occurred on 25 October and 1 December, due to the Meteosat-9 satellite's SEVIRI instrument switching to safe mode. Both events are considered as single-incident upsets without further consequences.

On 18 August, the outages lasted approximately three hours for imagery products and six hours for meteorological products. Nominal services could be restored by the on-call engineers within three hours, just as the primary FES service was about to be swapped to the Meteosat-8 back-up satellite.

On 25 October, the Meteosat-9 spacecraft autonomously switched to its redundant central processor. The RSS service was immediately swapped to Meteosat-8, leading to an outage of just over three hours, and the service could be swapped back to Meteosat-9 on 28 October. On 1 December, the Meteosat-9 SEVIRI instrument went on standby mode, leading to a five-hour interruption of the RSS service.

OPERATING COMPLEX SATELLITE SYSTEMS AROUND THE CLOCK

CONTINUED

There was no service outage resulting from the collapse on 22 November of one antenna in Usingen, which supports the Meteosat-8 back-up satellite. However, the capability of acquiring three Meteosat data streams simultaneously has been temporarily lost, bringing the availability of the RSS service back to the level achievable with only two MSG satellites in orbit.

Likewise, the blocking of the Meteosat-10 GERB instrument's de-spin mirror, which compensates for satellite rotation, had no impact on the availability of the service, which was delivered by the GERB instruments on Meteosat-8 and -9. The mirror has remained blocked since 27 April, despite many attempts to unblock it by several types of commands and under different conditions.

The first Meteosat satellite lifetime review was held to reassess the availability of all Meteosat systems, the impact of known anomalies on system operability, the projected fuel lifetime and scenarios for the optimum and the longest possible operational use of Meteosat assets. These reviews are being repeated on an annual basis for all EUMETSAT satellite systems.

LOW EARTH ORBIT SYSTEMS

The availability of the EPS system has been excellent, with only a few hours of outage due mainly to the harsh environment in space - referred to as "space weather" - experienced over the poles and the South Atlantic Anomaly.

The impact of space weather on some memory partitions of the on-board data recorders of both satellites precluded Metop-B data acquisition at McMurdo, thus degrading the timeliness of product delivery for about 40 hours, and caused the full loss of three orbits of Metop-B data (on 29 October) and three orbits of Metop-A data (on 12 November).

The Infrared Atmospheric Sounding Interferometer (IASI) data service from Metop-A was also interrupted for three days to upload a new version of the instrument on-board software already in use on Metop-B.

A 48-hour outage of Advanced TIROS Operational Vertical Sounder (ATOVS) temperature and moisture sounding products from both Metop satellites and NOAA-19 was due to an unforeseen impact of changes implemented in the processing chain to ingest background information available from a new, higher resolution version of the European Centre for Medium-Range Weather Forecasts (ECMWF) global model.

The performance of the ageing microwave sounders aboard Metop-A has continued to degrade. Two more channels of the AMSU-A1 temperature sounder have reached out-of-specification limits, with noise further increasing exponentially. The noise of two channels of the MHS microwave humidity sounder has also continued to increase and is expected to reach out-of-specification limits in 2014.

On Metop-B, the evolution of the noise affecting three channels of the High Resolution Infrared Radiation Sounder (HIRS) instrument has been erratic. All but one were back within specification at the end of the year, suggesting that the impact of the anomaly may be affected by thermal and seasonal modulation. The evolution of this anomaly remains under close observation.

Flying on a different, non-synchronous orbit inclined at 66°, the Jason-2 satellite completed its five-year design lifetime in orbit in June and continued to deliver high-precision observations of wave height, mean sea level and ocean currents, in support of marine meteorology, operational oceanography, seasonal forecasting and climate monitoring. The mean sea level data series which started in 1992 with Topex/Poseidon now covers 20 years, constituting an invaluable Climate Data Record.

Data service availability remained high in 2013 but 1% below the 95% target, due to outages resulting from the satellite moving into safe mode three times, on 25 and 30 March and on 5 September.

After the first two events, the mission was recovered on 5 April, but using the payload module's redundant processor (PM-B). Investigations led by CNES concluded in mid-September that the nominal processor (PM-A) was affected by an anomaly and could only be used for safe mode operations, contrary to PM-B, which was apparently only subjected to a single event upset on 5 September with no further consequences. CNES and industry are working on a software patch for the nominal processor to restore the lost redundancy of the mission.

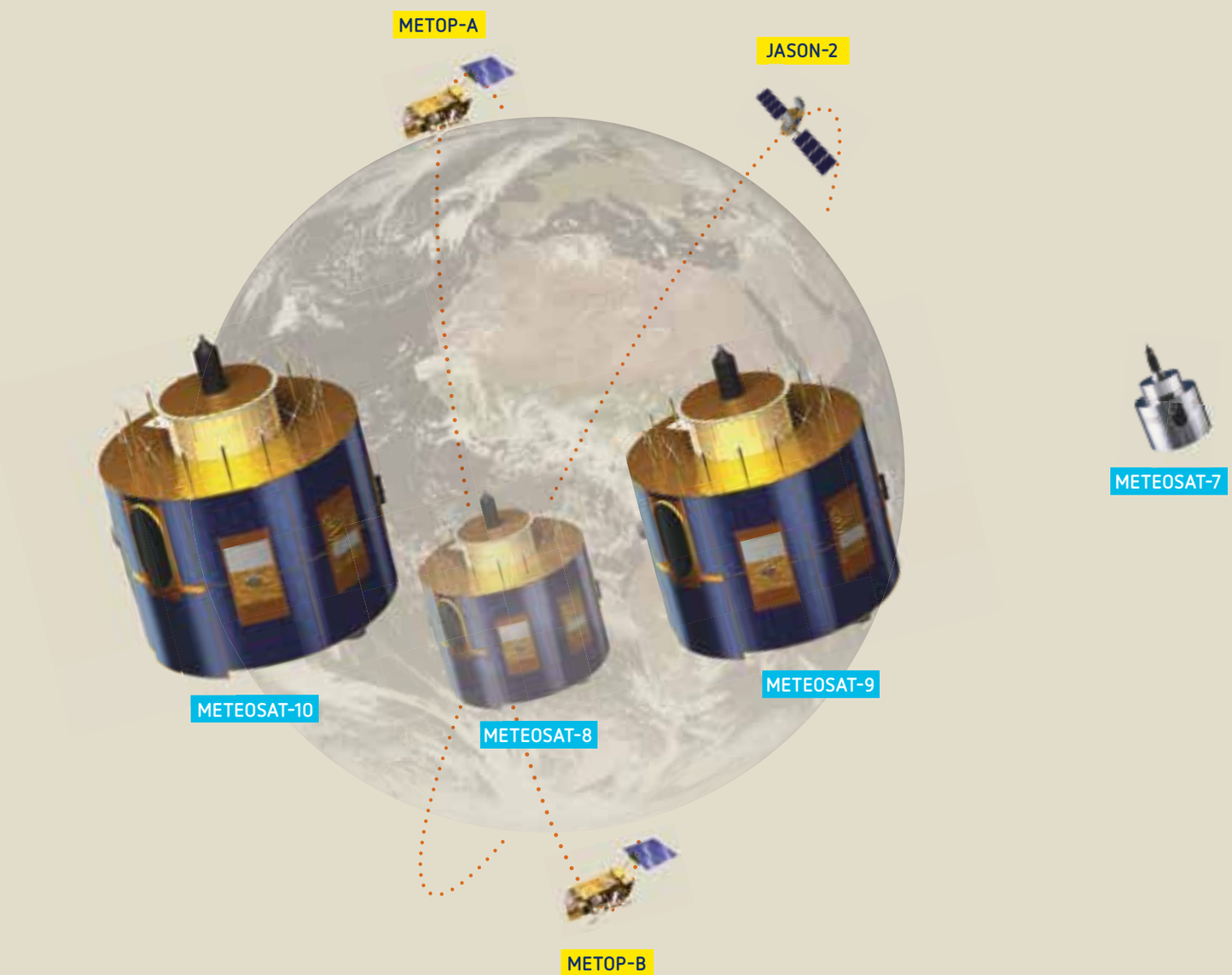
EUMETSAT SATELLITES IN 2013

METEOSAT SYSTEM

Meteosat-10	0° East	Full Disc Imagery	Took over the prime Meteosat full disc imagery service over the European continent, Africa and parts of the Indian oceans on 21 January 2013
Meteosat-9	9.5° East	Rapid Scan Service (RSS)	Delivering the RSS over Europe and adjacent seas
Meteosat-8	3.5° East	Meteosat Backup Service	Provides backup service for 0°, plus RSS from 9 April 2013
Meteosat-7	57.5° East	Indian Ocean Data Coverage (IODC)	Supporting the IODC mission, bridging an observation gap in this region

LOW EARTH ORBIT SYSTEMS

Metop-A	98.7° incl.	EPS	Kept in its nominal mid-morning sun synchronous orbit at 817km altitude
Metop-B	98.7° incl.	EPS	Became the primary operational satellite of the EUMETSAT Polar System (EPS) on 24 April 2013, following detailed commissioning
Jason-2	66° incl.	Ocean Surface Topography Mission	Kept in its nominal non-synchronous low Earth orbit at 1,336km altitude



OPERATING COMPLEX SATELLITE SYSTEMS AROUND THE CLOCK

CONTINUED

"The focus of EUMETSAT is on maximizing the availability of data, products and services to users in the most efficient manner. A resilient multi-mission ground segment is essential to achieve this."

Livio Mastroddi
Director of Operations and Services to Users
EUMETSAT

AN INCREASINGLY RESILIENT MULTI-MISSION GROUND INFRASTRUCTURE

The technical infrastructure required to support more resilient, flexible and cost-efficient multi-mission ground systems was set up inside the new Technical Infrastructure Building (TIB).

The optical fibre infrastructure was installed first and is equipped with a fully flexible patch cabling system allowing the physical connection of any technical room in the TIB to any "customer" control room in the main building. In addition, end-to-end connectivity is actively monitored by a system allowing fast detection and diagnosis of problems over the entire path.

After this, the enterprise single backbone network, called the Multi-Mission Interconnect Network, was deployed to offer interconnectivity to all missions' ground segments. This was followed by the new Storage Network Infrastructure (SNI), which, based on a highly scalable and flexible architecture involving virtualisation and "cloud" storage services, secures storage and back-up service continuity even in the case of a complete loss of one TIB building floor, while at the same time reducing energy consumption and carbon emissions.

An innovative data centre management system was implemented to monitor power and temperature at the level of each rack, duly identified by physical inventory information automatically downloaded from the EUMETSAT Enterprise Resource Planning (ERP) system.

The Jason-3 servers were then installed in the TIB, together with several multi-mission systems. The latter included the ingestion servers of the multi-mission archiving system (UMARF) and a new Multi-Mission Dissemination System (MMDS) that consolidates all facilities supporting near-real-time data dissemination for existing and future programmes into a single system. The migration of the Meteosat Second Generation ground segment also started under the MSG Ground Segment Computer Infrastructure Upgrade Project (MCIUP) with the replacement of all obsolescent hardware.

In order to reduce maintenance costs of generic ground segment elements, EUMETSAT has started to move to software architecture combining "common kernels" usable across multiple satellite systems and reduced mission-specific software. This approach is being tested first on the re-engineering of the EPS mission planning and flight dynamics facilities.

New storage systems and servers have been installed and interconnected in the Technical Infrastructure Building which will host the full EUMETSAT multi-mission ground segment in the future

DELIVERING SERVICES AND BENEFITS TO REAL-TIME USERS

The delivery timeliness of products from EUMETSAT and NOAA polar satellites was further improved and the EUMETCast broadcast service continued to deliver time-critical data to users worldwide with record availability, while important decisions were made for its adaptation to future needs.

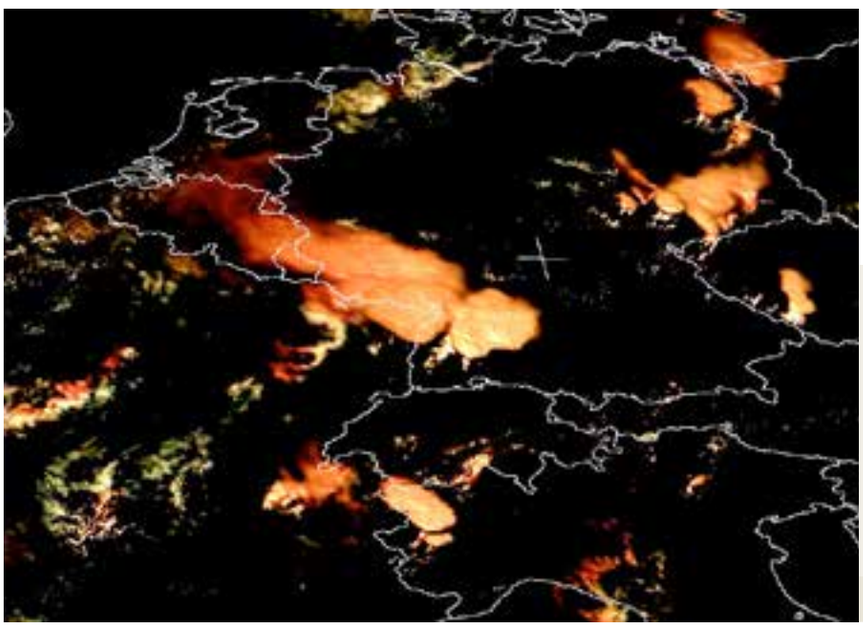
EUMETSAT's primary mission is real-time delivery of critical information extracted from observations of its own and partners' satellites to Member and Cooperating States' National Meteorological Services, the European Centre for Medium-Range Weather Forecasts (ECMWF) in support of the official duties of the former, as well as to authorised users worldwide.

Once again, EUMETSAT's inputs were essential for forecasting and managing high impact weather situations and further reducing errors in Numerical Weather Prediction models, which brings great benefits to citizens, decision-makers and the weather-sensitive sectors of Member States' economies.

METEOSAT IMAGERY CENTRAL TO NOWCASTING OF SEVERE WEATHER

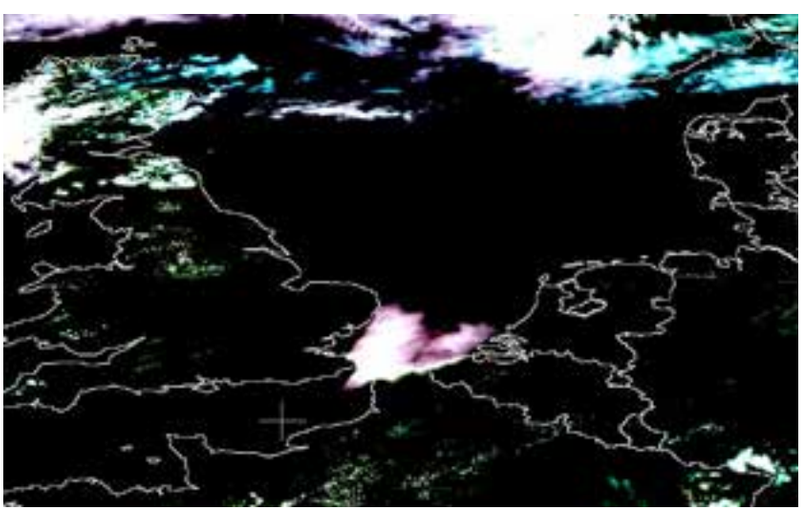
Forecasters use frequent images from Meteosat for the "nowcasting" of rapidly developing, high-impact weather up to a few hours ahead. Imagery is also used for real-time checking of previous forecasts against actual observations and to refine the forecast "scenario".

Meteosat imagery helps detect and monitor fog formation and nowcast its dissipation, which is particularly important in sensitive localised areas, for example, around airports, major road networks, ports and shipping routes. On 18 July, Meteosat imagery clearly differentiated the foggy patch over the channel from the clear areas in other parts, in particular over the London airports where no fog was reported.



Severe convective storms constitute another type of high-impact weather, usually accompanied by strong winds, heavy rainfall and hail, which can be a threat to life and property. This was aptly illustrated by the convective episode that ended several weeks of dry weather in Germany on 6 August 2013. Directly hitting the region of Hesse, this particular severe weather event interrupted trains and traffic around Frankfurt after gusts of strong wind brought down branches and trees in the area. The event also dumped hailstones up to 12 cm in diameter on several regions of Germany.

Thunderstorms over Germany 6 August 2013, 13:00 UTC captured by Meteosat-10 (High Resolution Visible Channel enhanced with VIS0.8, NIR1.6 and IR3.9)



Fog over the English Channel as seen by Meteosat-10, 18 July 2013 12:00 UTC (High Resolution Visible Channel enhanced with VIS0.8, NIR1.6 and VIS0.6)

DELIVERING SERVICES AND BENEFITS TO REAL-TIME USERS

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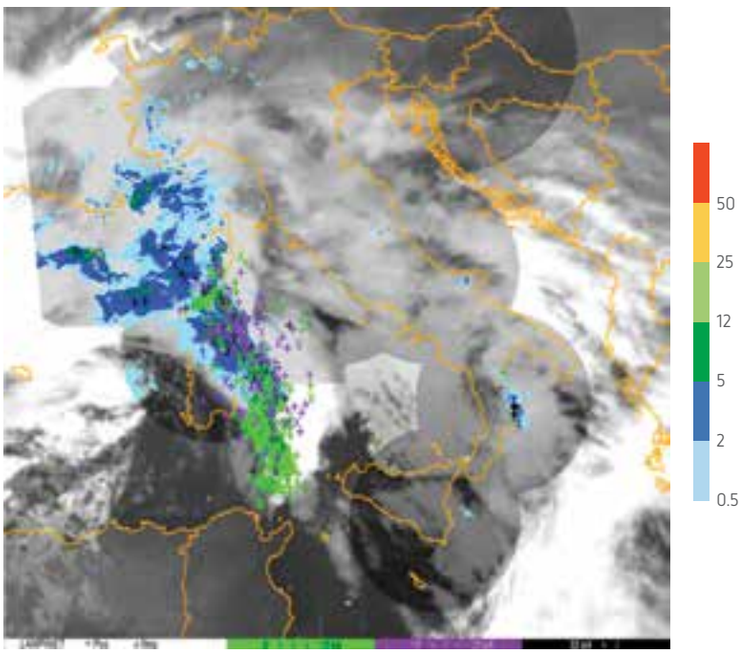
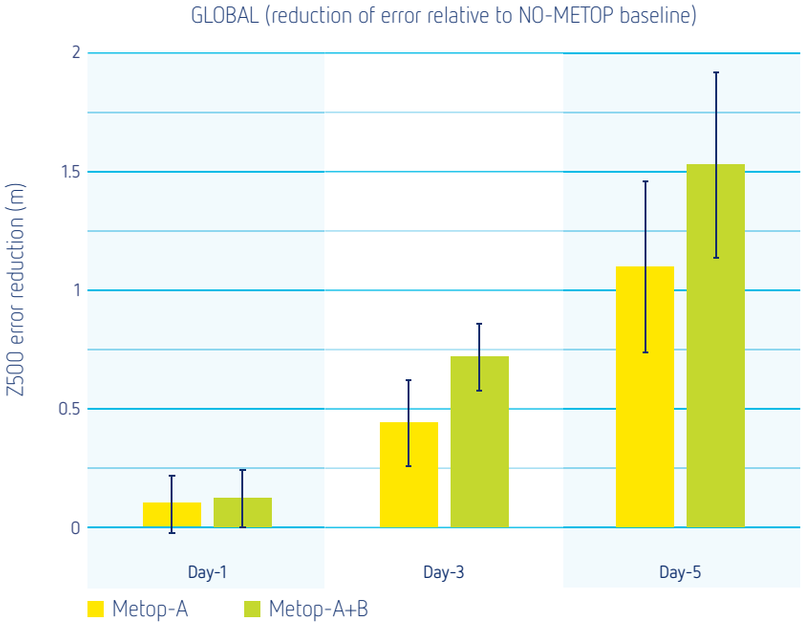


Slow moving thunderstorms creating high cumulative precipitation and floods over Sardinia, as depicted by Meteosat infrared imagery, combined with weather radar and lightning data 18 November 2013

On 18 November, the western seas of Italy were affected by slow-moving thunderstorms, triggered by an unstable moist southerly flow associated with a low pressure system positioned over the western Mediterranean and caused by a strong warm advection from the Strait of Sicily, where sea surface temperature was three degrees above normal. All this led to a significant convective development causing extensive rain over the north-easterly part of Sardinia (450 l per m^2 in 24 hours, which is half the average annual cumulated rainfall), resulting in massive flooding and rivers bursting their banks and destroying houses. The ultimate toll was 17 casualties, hundreds of homeless citizens and damage amounting to over €1 billion.



Previous-day numerical forecasts had already indicated a high probability of a severe storm system affecting Sardinia, but only the comparison of these forecasts with real-time satellite imagery showing cloud structures allowed the forecasters to establish the accuracy of the forecast and confirm the high amount of precipitation expected over a short timeframe. This helped warn the civil protection authorities several hours in advance, thus avoiding even more casualties and losses.

METOP OBSERVATIONS HELP IMPROVE NUMERICAL WEATHER PREDICTION FORECASTS

Global and regional Numerical Weather Prediction (NWP) models, used by forecasters as the main source of information for forecasts from 12 hours to 10 days ahead, rely mainly on global observations from polar-orbiting satellites like EUMETSAT's Metop spacecraft. Observations of the ocean from Metop and Jason-2 satellites are used for forecasting sea state and dispersion of marine pollutants and for seasonal forecasting.

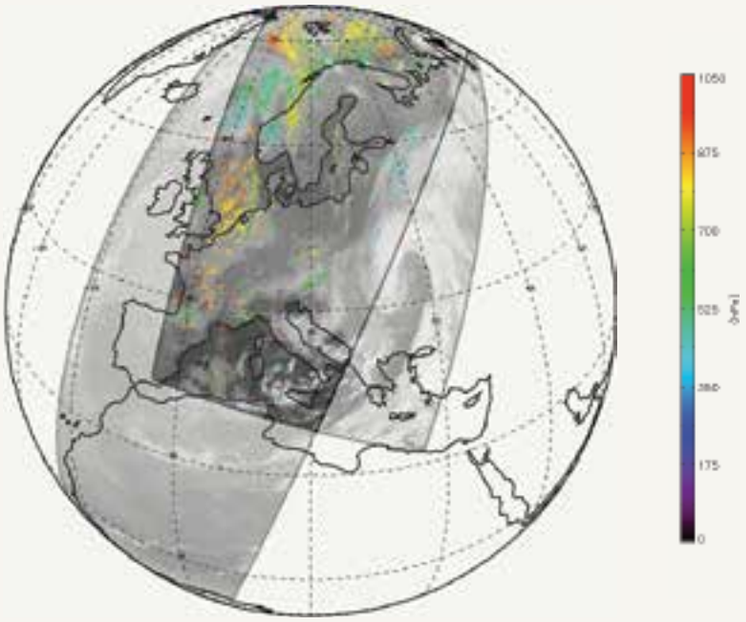
Dual Metop operations have brought significant additional benefits to Member States and users, as measured in a statistical assessment conducted by ECMWF showing that the combined impact of both satellites on NWP skill is superior to the impact of Metop-A alone.

Beyond these statistics, the ingestion of Metop observations by NWP models has continued to be instrumental for the delivery of medium range forecasts of high impact weather and early warnings in Europe. On 5-6 December, severe damage, extensive flooding and the worst North Sea storm surge for decades was observed in the wake of winter Atlantic storm Xaver and affected most of Northern Europe. The coast of the UK was first hit by a massive storm surge on 5 December, caused by the conjunction of high tides, winds and waves. On 6 December, Xaver moved on to Northern Europe, causing major flooding, severe damage and at least nine deaths. However, thanks to early warnings based on medium range weather forecasts from ECMWF, civil protection authorities across Europe could prevent further losses. This was particularly

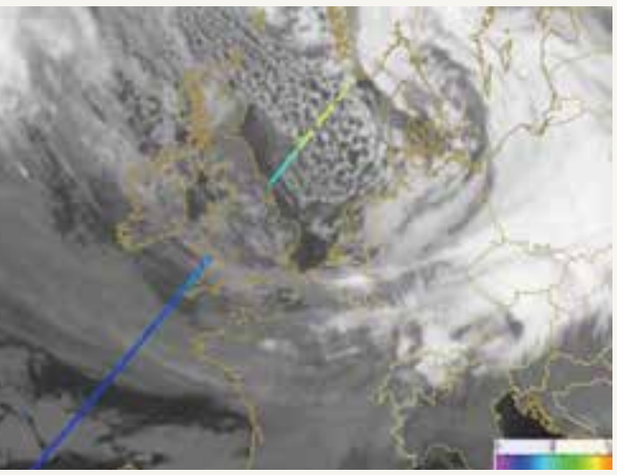
Reduction of forecast error for day-1, day-3 and day-5, due to the ingestion of data from one (yellow) and two (green) Metop satellites (source: ECMWF)

the case on the North Sea coastline of Germany, where the flood levels were comparable to those of the so-called "flood of the century" in 1962, which caused 340 fatalities.

Dual Metop operations also created unique opportunities to extract global wind vector products from the observation of cloud displacement by overlapping visible and infrared images taken by both satellites 48 minutes apart.



Overlapping images from Metop-A and B: the first track, on the left side, is from Metop-A, and the second is from Metop-B, 48 minutes later. As both tracks overlap it is possible to infer wind vectors from the observed cloud displacement within 48 minutes



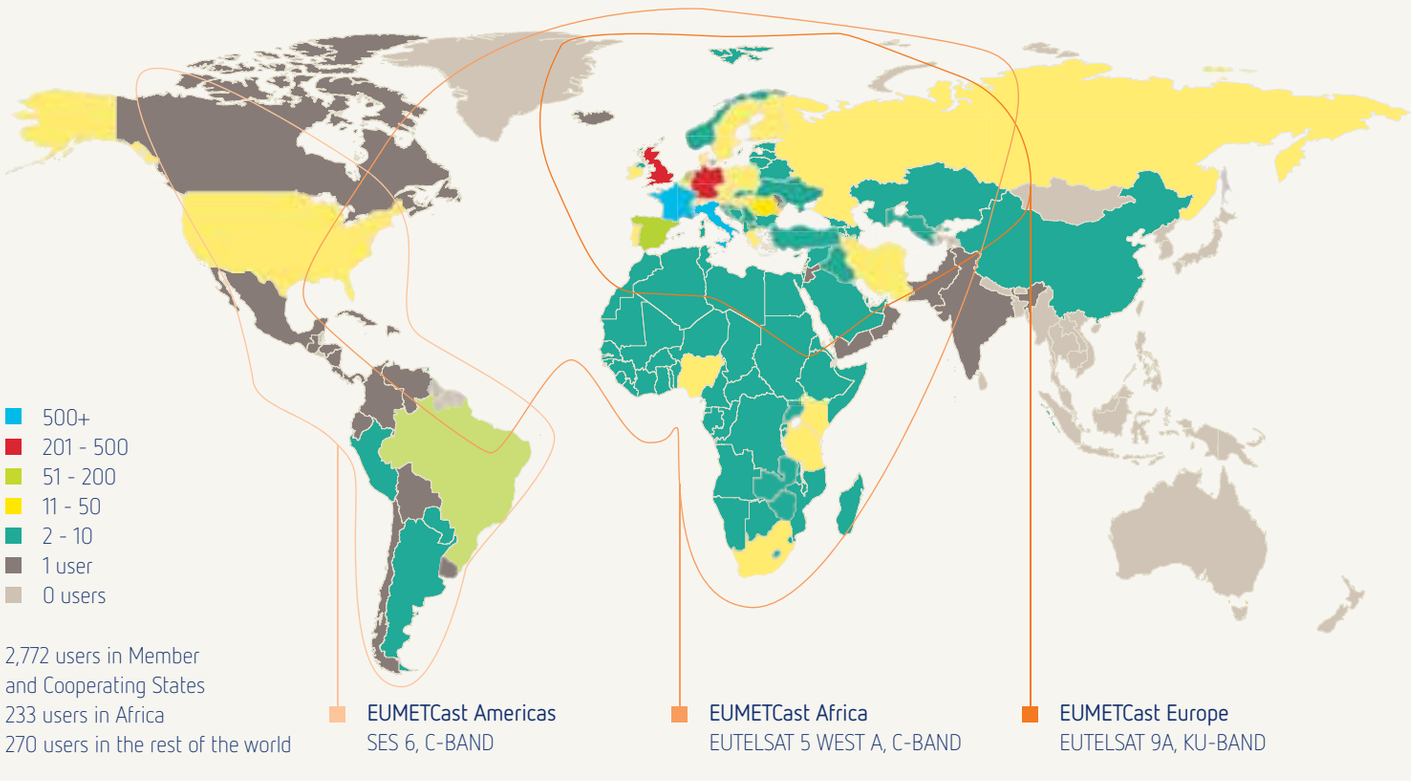
Meteosat-10 channel IR10.8 imagery and Jason-2 track superimposed showing storm "Xaver" and its impact on sea state, on 5 December 2013, 18:00 UTC (source: EUMETrain)

DATA ACCESS AND REAL-TIME DELIVERY

AVAILABILITY OF EUMETCAST SERVICES REMAINS AT RECORD HIGH LEVELS

The availability of the EUMETCast dissemination services to Europe, Africa and Americas remained at record high levels in 2013. The only significant outage affecting all services occurred on 24 June, when an anomaly in the administration software caused a 40-minute interruption of high-frequency, time-critical Meteosat image data products. An operational workaround was implemented to prevent a recurrence and a software correction was developed. The EUMETCast Americas service, which Council agreed to continue until the end of 2015, was further interrupted for 45 minutes to fix a technical problem at the data uplink site and was degraded for 7.5 hours due to traffic saturation at the service provider.

EUMETCast coverage and worldwide user distribution, December 2013



DELIVERING SERVICES AND BENEFITS TO REAL-TIME USERS

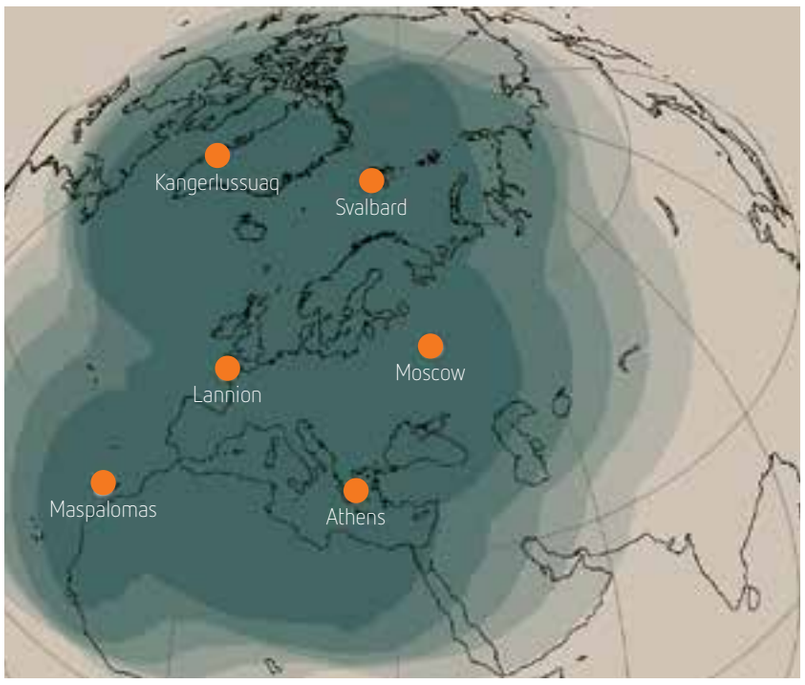
CONTINUED

In order to disseminate higher data volumes from future EUMETSAT and Copernicus satellites over Europe, starting in 2015, EUMETSAT decided to implement the new, more efficient DVB S2 standard and procured a full Ku-band transponder on the Eurobird-10 satellite at 10° E.

TIMELINESS OF GLOBAL IJPS DATA IMPROVES FURTHER

The timeliness of delivery of global level 1 products from the Metop-A, Metop-B and NOAA-19 satellites, which together form the Initial Joint Polar System (IJPS) shared with the US, was further improved in June, following a cost-effective bandwidth increase of the Svalbard to Darmstadt communications link, from 3.9 Mbps to 8 Mbps for both Metop data streams, and from 300 kbps to 1 Mbps for NOAA-19 data. The average timeliness of level 1 products extracted from Metop-A and NOAA-19 data - acquired only at Svalbard - improved from 101 minutes to 82 minutes and from 85 minutes to 72 minutes, respectively, from the time of sensing. The average availability of products extracted from Metop-B data - also acquired at McMurdo - improved from 59 minutes to 47 minutes. For all three data streams, the best achievable timeliness has improved even more significantly.

Network of EARS stations acquiring Suomi NPP data in Europe and surrounding countries



THE EARS REGIONAL DATA SERVICE EXPANDS IN SCOPE

For regional data, the EUMETSAT Advanced Retransmission Service (EARS) system allows for even quicker dissemination of selected products, 15 to 30 minutes from sensing, through the local processing, collection and redistribution of data acquired by a regional network of stations. The availability of the system continued to be very high in 2013, with only a one-month outage of the Muscat station during the replacement of hardware.

One major achievement in 2013 was the introduction of EARS services for temperature and moisture soundings from the Advanced Technology Microwave Sounder (ATMS) and Cross-track Infrared Sounder (CrIS) instruments on the US Suomi NPP satellite. These new EARS services (EARS-ATMS and EARS-CrIS) became fully operational on 15 May, based on data acquired and processed at the Svalbard, Lannion, Maspalomas and Athens stations using the Community Satellite Processing Package (CSPP) provided by the University of Wisconsin-Madison.

The introduction of a new EARS-NWC (Nowcasting) service delivering cloud products extracted from Metop imagery using software from the Satellite Application Facility on Support to Nowcasting and Very Short Range Forecasting (NWC SAF) constituted another significant addition.

IMPROVED DATA ACCESS SERVICES

The pilot open Web Map Service (WMS) was released, allowing users to visualise near-real-time imagery, RGB colour composites and other products in a "Google Earth-like" environment that facilitates their use, in combination with geospatial information from other Web Map Service providers.

Improvements to the Data Centre infrastructure and service included the integration of a user feedback mechanism into the archive ordering process and the development of a lightweight, more intuitive online ordering client, which is expected to replace the current Java-based client in 2014.

DELIVERING CLIMATE SERVICES

As they continue to build the longest records of our changing climate from space, meteorological satellites form a key asset of the "observation and monitoring" pillar of the Global Framework for Climate Services. EUMETSAT is therefore developing recalibration and reprocessing methods and capabilities for extracting Climate Data Records from its archives, in support of climate research and the development of climate services.

EUMETSAT's climate monitoring activities involve its central facilities in Darmstadt, the network of Satellite Application Facilities (SAFs), with a leading role for the SAF on Climate Monitoring, and contributions to selected collaborative projects with international partners. These activities rely on the archiving and data processing infrastructure available at EUMETSAT headquarters and in the SAFs.

The activities encompass recalibration and inter-satellite calibration, production of Fundamental Climate Data Records through reprocessing of physical measurements ("level 1"), downstream production of Thematic Climate Data Records for selected Essential Climate Variables through reprocessing of geophysical products ("level 2"), as well as validation and quality assessment.

Climate records can then be used directly or assimilated into the best available Numerical Weather Prediction models used in "reanalysis" mode to produce consistent records with a broader range of variables.

The year 2013 was marked by important developments in the area of methods and quality assessment, the delivery of new EUMETSAT Climate Data Records to ERA-CLIM and other projects. EUMETSAT also joined two new projects of the EU FP7 Programme, namely ERA-CLIM2 proposed by ECMWF to deliver a global 20th century re-analysis, and QA4ECV (Quality Assurance for Essential Climate Variables) proposed by the Royal Netherlands Meteorological Institute (KNMI) to achieve a "traceable quality assurance system for multi-decadal ECVs".

For the FP7 CORE-CLIMAX project, EUMETSAT developed new concepts for assessing the European capacity to create Climate Data Records, which were endorsed by all key European players, NOAA and other agencies represented on the CEOS Working Group on Climate.

RECALIBRATION AND PRODUCTION OF FUNDAMENTAL CLIMATE DATA RECORDS

The methods developed in 2012 to cross-calibrate all Meteosat infrared channels with Infrared Atmospheric Sounding Interferometer (IASI) reference spectra were extended by combining historical Meteosat measurements with those of the High Resolution Infrared Sounder (HIRS). This involved a match-up database co-locating all historical Meteosat observations with the closest ones from the IASI sounders on the Metop satellite and HIRS instrument data on historic NOAA satellites.

Two candidate calibration methods were implemented for the reprocessing of Advanced Scatterometer (ASCAT) level 1b data and evaluated by ECMWF, KNMI and other experts, who selected one (the so-called "constant calibration") for full reprocessing. The resulting Fundamental Climate Data Record was produced accordingly and delivered to ECMWF for evaluation as part of the ERA-CLIM project.

Resources were then redirected to the reprocessing of atmospheric bending angle data from the radio occultation instruments flown on the Metop, CHAMP and COSMIC satellites, for which software was delivered in December.

The Climate Monitoring (CM) SAF released a Fundamental Climate Data Record of SSM/I brightness temperatures covering the period between July 1987 and December 2008.

PRODUCTION OF THEMATIC CLIMATE DATA RECORDS

The Meteosat first generation surface albedo data record was expanded with the addition of more than four years (2006-2011) of Meteosat-7 Indian Ocean Data Coverage (IODC) products and four years (1991-1995) of Meteosat-3 Atlantic Data Coverage/ Extended Atlantic Data Coverage products. A new set of user documents addressing algorithms, validation and guidance to users was under review at the end of 2013.

DELIVERING CLIMATE SERVICES

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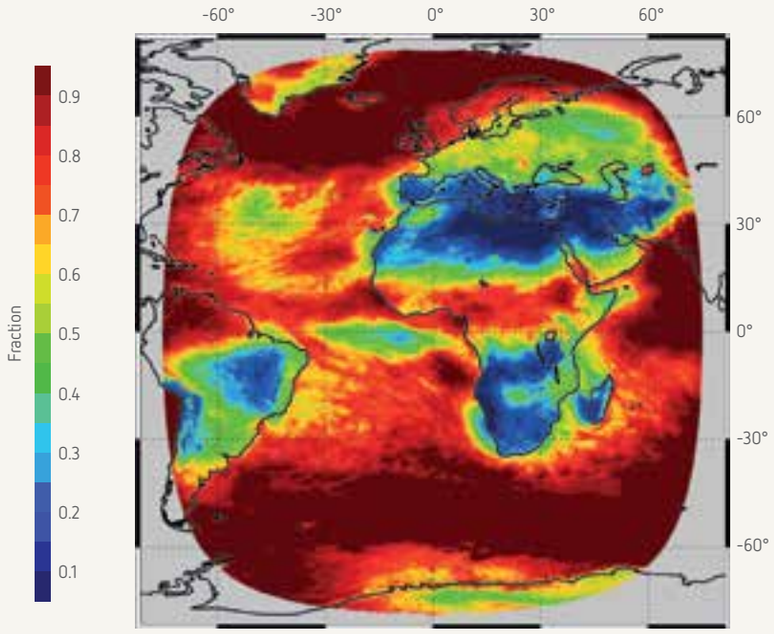


Monthly averaged CLAAS product for cloud fraction (CFC) with a latitude-longitude sampling of 0.05 degree (source: CM SAF)

An undersampling strategy was tested and adopted to speed up the reprocessing of MSG products by a factor of ~2.5, while fulfilling the needs of reanalysis projects. Thus, more than two years of MSG wind vector and radiance products have already been reprocessed, including the full year 2008, and the full Climate Data Record will become available by mid-2014.

The processing of polar winds (AMV) derived from Metop-A's Advanced Very High Resolution Radiometer (AVHRR) imagery has been completed and the Thematic Climate Data Record was delivered to the ERA-CLIM project after finalisation of user documentation. Its scientific validation has progressed based on comparison with output from a second AVHRR algorithm and the reprocessed MSG AMV products for the year 2008, showing high consistency among different algorithms.

The Climate Monitoring (CM) SAF released a number of Climate Data Records, including the following:

- seven-year record (2004-2011) of top of atmosphere radiation products extracted from Meteosat Second Generation GERB data;
- 23-year record (1983-2005) of surface net shortwave radiation products extracted from Meteosat first generation imagery data;
- 27-year record (1983-2009) of free tropospheric humidity products extracted from Meteosat first generation (Meteosat-2 to -5 and Meteosat-7) and Meteosat Second Generation (Meteosat-8 and -9) imagery data;
- 13-year record (1999-2011) of water vapour products (total column and in selected atmospheric layers) extracted from Advanced TIROS Operational Vertical Sounder (ATOVS) data;
- eight-year record (2004-2011) of cloud properties (CLAAS) extracted from Meteosat Second Generation SEVIRI data.

The Radio Occultation Meteorology (ROM) SAF also released a five-year record (2008-2012) of temperature and humidity profiles extracted from COSMIC data.

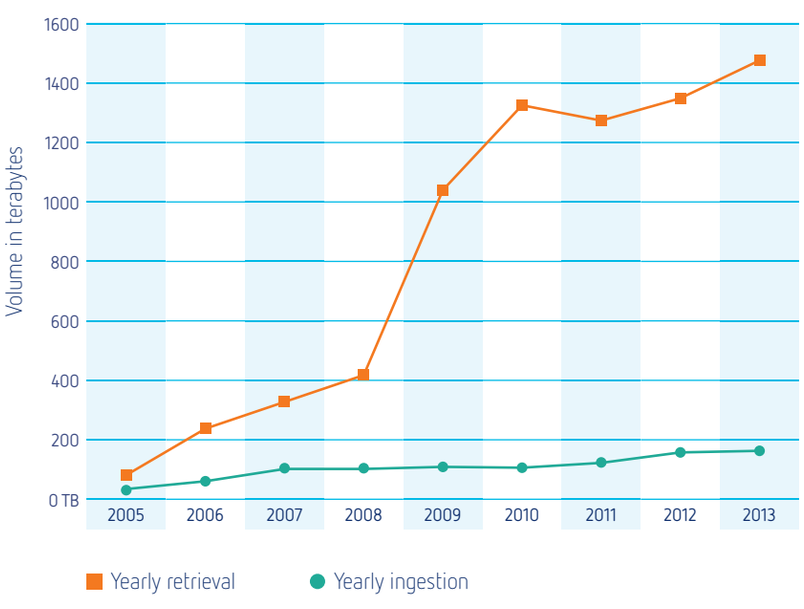
ADAPTING EUMETSAT'S GROUND INFRASTRUCTURE

The MSG reprocessing facility, which is expected to facilitate reprocessing and validation through fast access to the Unified Meteorological Archive and Retrieval Facility (UMARF), was tested and the infrastructure supporting the planned reprocessing of radio occultation data entered final testing in December.

In addition to these ad hoc developments, a more comprehensive infrastructure project, named the Climate Data Record (CDR) project, was initiated to design and implement in the most efficient way the reprocessing infrastructure upgrades required for the multi-annual climate service development plan established in 2013, starting with a requirements analysis phase.

A new Tape Library with a capacity of 10,000 slots was installed on the fourth floor of the Technical Infrastructure Building (TIB) in August and will become the Operational Tape Library after testing, which is expected to be completed in 2014.

EUMETSAT DATA CENTRE: A LIVING ARCHIVE



DEVELOPING ENHANCED AND NEW PRODUCTS IN PARTNERSHIP WITH MEMBER STATES

Cooperative development across the EUMETSAT distributed application ground segment was again essential in 2013 to bring innovative products to operational status and prepare for more in the future, to the benefit of an increasing range of applications and users.

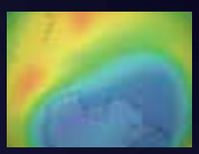
In order to exploit the full potential of its satellites in a broad range of meteorological and environmental applications, EUMETSAT has adopted a distributed architecture for its application ground segment, involving central facilities in Darmstadt and a network of Satellite Application Facilities (SAFs), each specialised in one application area. Each SAF constitutes a consortium of institutes from Member States, led by a National Meteorological Service.

This network allows the best use of distributed resources for the development and delivery of innovative products, capitalising on specialised scientific expertise, close interactions with application experts and cross-network cooperation.

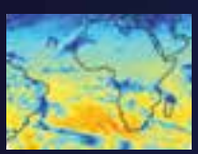
NWC SAF
Support to Nowcasting and Very Short Range Forecasting
Led by Agencia Estatal de Meteorología, Spain

LSA SAF
Land Surface Analysis
Led by Portuguese Meteorological Institute

OSI SAF
Ocean and Sea Ice
Led by Météo France

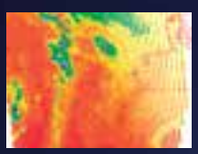


O3M SAF
Ozone and Atmospheric Chemistry Monitoring
Led by Finnish Meteorological Institute



CM SAF
Climate Monitoring
Led by Deutscher Wetterdienst, Germany

ROM SAF
Radio Occultation Meteorology
Led by Danish Meteorological Institute



NWP SAF
Numerical Weather Prediction
Led by Met Office (UK)

H SAF
Support to Operational Hydrology and Water Management
Led by Italian Meteorological Institute

DEVELOPING ENHANCED AND NEW PRODUCTS IN PARTNERSHIP WITH MEMBER STATES

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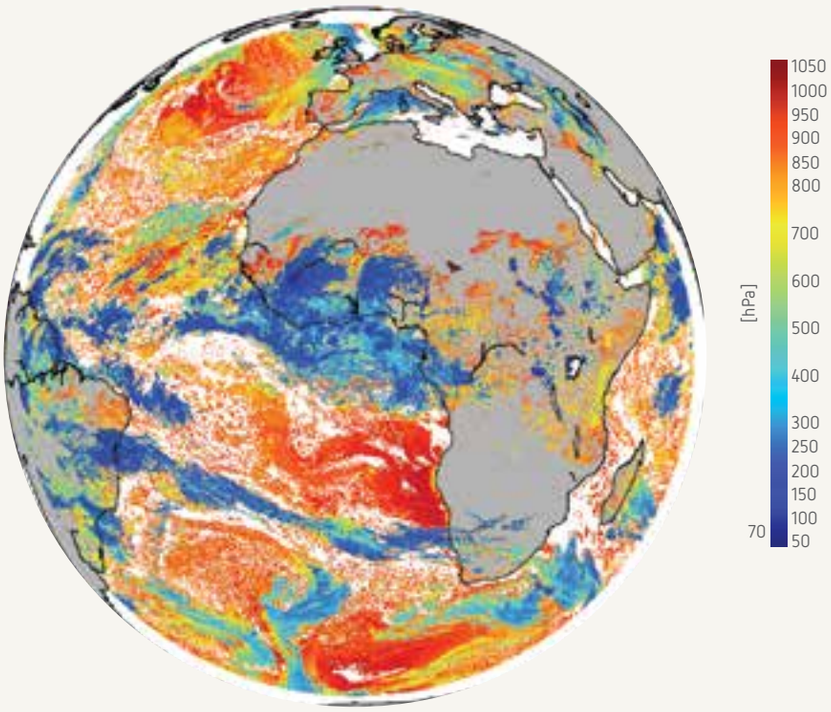


Cloud Top Pressure (hPa) as determined by the Optimal Cloud Analysis algorithm

NEW OPERATIONAL PRODUCTS

The introduction and development of new products restarted progressively at headquarters, as EUMETSAT scientists and engineers were released from Meteosat-10 and Metop-B commissioning and product validation tasks.

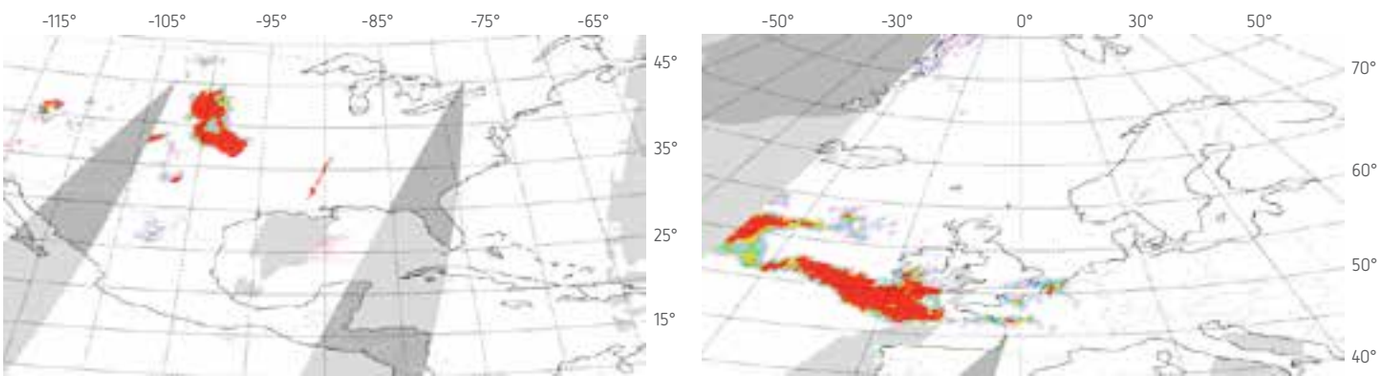
As a result, only two new real-time products became operational in 2013. An Active Fire Monitoring Product was introduced over Europe using Meteosat rapid scan imagery, followed by the first release of an Optimum Cloud Analysis product extracting cloud properties from Meteosat imagery even in the presence of multiple cloud layers.

This was more than compensated for by the introduction of new third-party data services, capitalising on established cooperation with other satellite operators, and by the release of new operational products by the SAF network, which was the primary source of innovation in 2013.

New third-party data services include real-time delivery of soil moisture products from the ESA SMOS Earth Explorer mission, precipitation imagery from the MWRI microwave imager on the Chinese FY-3B polar-orbiting satellite, sea state and ocean surface topography products from the Indo-French SARAL altimeter mission, and imagery (six channels: 0.9µ, 3.8µ, 8.0µ, 9.7µ, 10.7µ and 11.9µ) from the Russian Electro-L N1 geostationary satellite, provided every 30 minutes by Roshydromet.

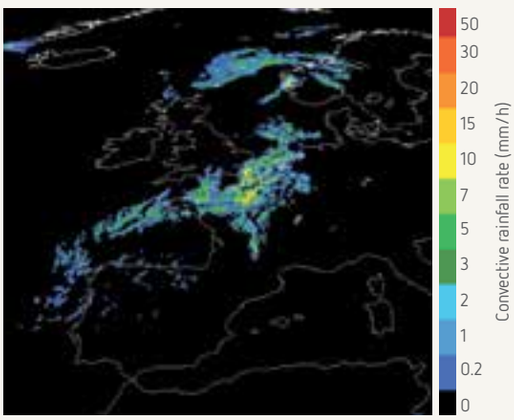
The new SAF products address a broad range of applications and include the following:

Atmospheric composition: new products included an Absorbing Aerosol Index extracted from polarisation measurements of the GOME-2 instrument detecting absorbing aerosols in the atmosphere, and tropospheric nitrogen and sulphur dioxide concentration products (O3M SAF).



Absorbing Aerosol Index extracted from Metop/GOME-2 data, showing a smoke plume generated by wild fires in Colorado on 20 June 2013 (left) propagating over the Atlantic to reach Europe on 25 June (right) (source: O3M SAF)

Meteorology: a new nowcasting software package (NWC SAF) enables the discrimination between convective and stratiform precipitation and the retrieval of information on convective precipitation from cloud microphysical properties inferred from Meteosat multi-spectral imagery.

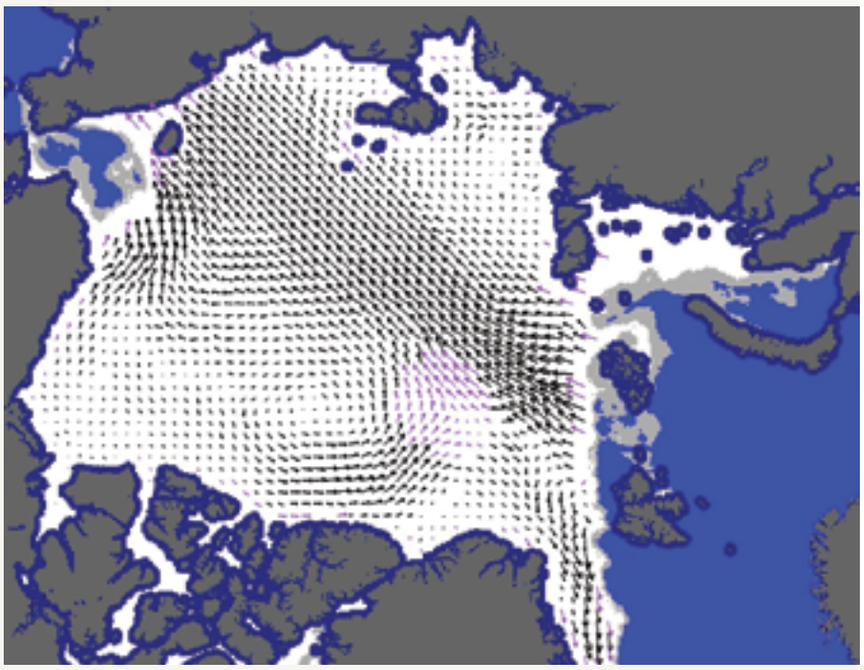


Convective rainfall rate inferred from cloud microphysical properties retrieved from Meteosat imagery, using a new software of the NWC SAF

Ocean and Sea Ice: the portfolio of ocean surface wind products derived by the OSI SAF from the ASCAT instrument now includes a 25 km resolution version and a dedicated product for coastal winds with 12.5 km sampling. A new Low Resolution Sea Ice Drift product depicting ice motion vectors over 48 hours was also introduced.

Land surfaces: the 10-day average Meteosat surface albedo product became fully operational (LSA SAF).

MSG 10-Day Surface Albedo product (source: LSA SAF)



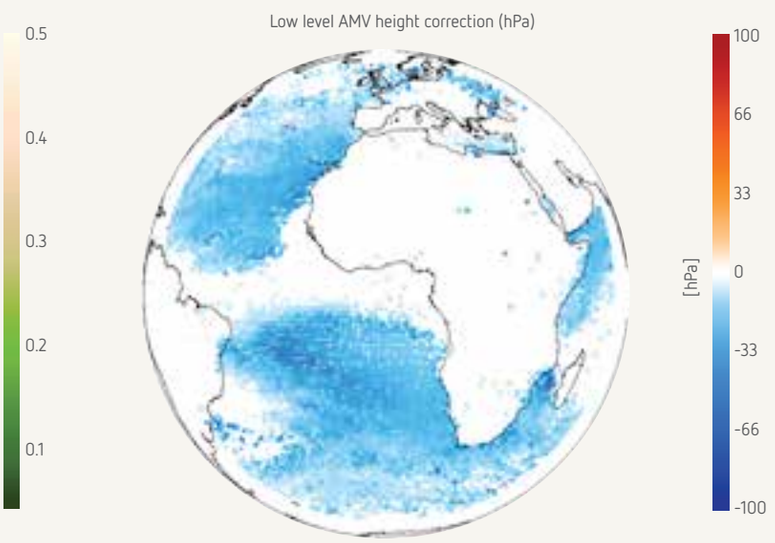
Low resolution Sea Ice Drift depicting ice motion over 48 hours in the Arctic (source: OSI SAF)

IMPROVEMENTS TO EXISTING PRODUCTS

Some calibration procedures were enhanced to improve the quality of image and downstream products.

Calibration coefficients were updated for the visible channels of Meteosat-9, moon observations were routinely extracted for additional calibration, and Meteosat-10 infrared imagery products were augmented by IASI-SEVIRI cross-calibration coefficients. An external calibration campaign was also performed for IASI on Metop-B and cross-calibration monitoring was introduced between the IASI instruments and the similar CrIS instrument on the US Suomi NPP satellite.

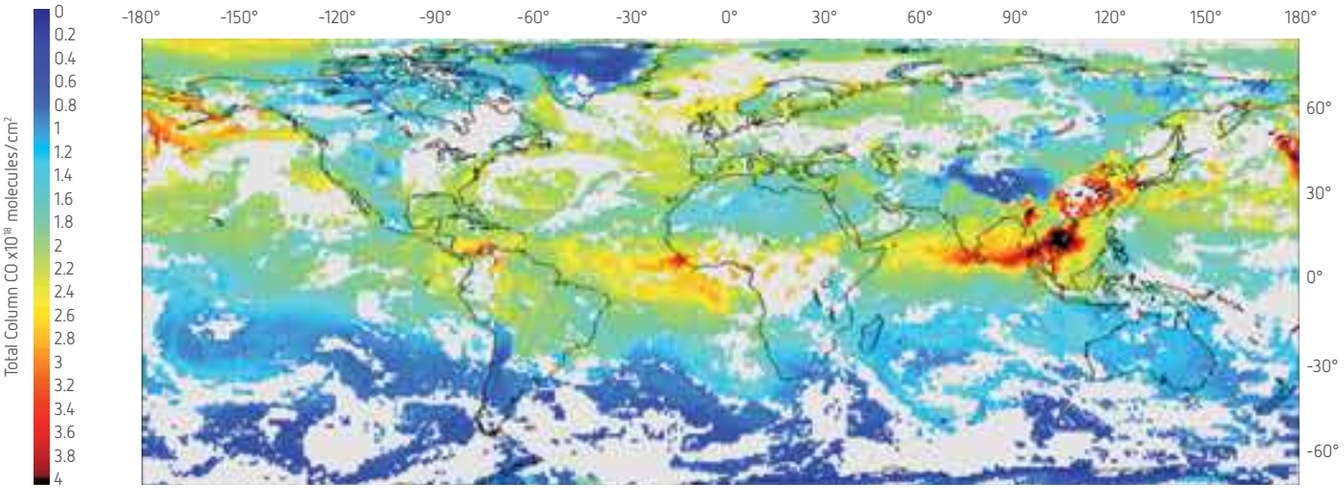
A change in the algorithm for assigning an altitude to low level wind products extracted from Meteosat imagery has reduced the biases with respect to ECMWF model analyses by around 25 hPa over large areas. The Meteosat Volcanic Ash product was also improved by changes introduced to the radiative transfer model.



Map of the 20-day average (8 – 23 February 2013) difference between the altitude (in hPa) assigned to Meteosat low level wind products using the new and the old algorithms, showing a significant reduction of the bias

DEVELOPING ENHANCED AND NEW PRODUCTS IN PARTNERSHIP WITH MEMBER STATES

CONTINUED



Retrieval of CO column from IASI observations using a O3M SAF/ULB/ LATMOS algorithm

A new sampling strategy was adopted for ASCAT radar backscatter triplets (level 1b) products, enabling more direct comparison between products at different spatial resolutions (25 and 50 km), and inclusion of additional quality information. A new backscatter product at full sensor resolution became operational, offering an enhancement potential of downstream geophysical products, in particular soil moisture.

The global data service from the CrIS and ATMS temperature and moisture sounders on the US Suomi NPP satellite was enhanced with the addition of collocated cloud cover and top height information, extracted by EUMETSAT from NOAA-provided imagery from the VIIRS instrument also flying on this satellite.

The enhanced products released by the SAFs include the High Spatial Resolution GOME-2 Ozone Profiles (O3M SAF) operational for both Metop-A and -B, and the improved precipitation rate and accumulated precipitation products extracted from observations of conical and cross-track scanning microwave radiometers using new algorithms (H SAF).

Enhanced user software packages were also released by the SAFs and made available on their web pages, including new versions of the Wind Data Processing software for scatterometer data (NWP SAF), the RTTOV radiative transfer model, the AAPP software used to extract temperature and moisture soundings across the EARS station network (NWP SAF) and the Radio Occultation Processing Package (ROM SAF).

PROGRESS IN SCIENTIFIC DEVELOPMENTS TARGETING FUTURE PRODUCTS

Development activities regarding additional new and enhanced products planned to be released in the future have also progressed.

The processor used to derive winds from Metop imagery in the polar regions has been upgraded to introduce algorithmic innovations aimed at better assigning the altitude of the estimated winds with respect to the altitude of the tropopause and temperature inversion levels.

Vertical atmospheric profiles extracted from GRAS radio occultation observations using a prototype processor implementing wave optics algorithms have continued to be distributed to selected users for evaluation of their capability to retrieve profiles deeper into the lower troposphere.

A new IASI level 2 processor was developed and implemented to use microwave data more efficiently for initialisation and improving the accuracy of vertical profiles of water vapour. This processor will also deliver new trace gas (CO, SO2) products based on algorithms developed by the O3M SAF.

In addition, a multi-sensor processor has been developed to extract aerosol information from colocated GOME-2 and AVHRR observations, starting with an aerosol optical depth product over the ocean.

Development activities have also progressed within the SAF network, targeting new products and user software to be released in 2014, including sea ice surface emissivity (OSI SAF) and snow status (dry/wet) (H SAF) products, both extracted from microwave imagery, evapotranspiration and land surface temperature composites extracted from Meteosat imagery (LSA SAF) and a single integrated 1D-Var user software package replacing all instrument specific software (NWP SAF).

Two SAF network workshops were held, in March and December, to discuss SAF contributions to the development of future MTG and EPS-SG products.

SUPPORTING AND EXPANDING THE USER BASE

To realise the benefits of strategic investment in advanced satellite systems, EUMETSAT adopted a new, five-year training plan, embarked on new capacity building initiatives in Africa and maintained sustained interactions with a growing community of users.

A COLLABORATIVE APPROACH TO USER TRAINING

The provision of training for users is crucial for developing the use of EUMETSAT data for a growing range of meteorological, climate and environmental applications and also for expanding the user base. EUMETSAT's contribution to training is part of an integrated cooperative effort, mobilising expertise, resources and funding across partners, in particular within the European Meteorological Infrastructure[1]. This cooperation involves experts on satellite products and those familiar with the applications and associated techniques for using satellite data, across the network of Satellite Application Facilities (SAFs) and the network of international training experts established in the context of the World Meteorological Organization (WMO) Virtual Laboratory (VLab).

In order to implement the training strategy agreed in 2012, Council approved a five-year plan addressing activities and allocated resources for 2014-2018.

In line with the objective of developing e-learning and optimised combination with "classroom" training, EUMETSAT held its largest live, online training event, involving 300-400 participants from 33 countries accessing online presentations from 150 different locations and interacting with precipitation experts. In addition, EUMETSAT supported a training course in Oman, the first incorporating a distance lecture in Arabic from the new WMO Centre of Excellence in Casablanca, Morocco, inaugurated in 2013.

[1] The EMI is composed of the European National Meteorological Services, their EUMETNET grouping, ECMWF and EUMETSAT

LIST OF TRAINING EVENTS IN 2013

FEBRUARY
Online Training week on Precipitation

EUMETSAT Satellite Application Course for the Middle East region (ESAC-ME-IX), Muscat, Oman, supported by the Centre of Excellence in Casablanca

MARCH
Third SALGEE Workshop on MSG Land Surface Applications, focusing on drought and fire emissions, Ericeira, Portugal

APRIL
Training on Using Satellite Products in Meteorology and Oceanography, Kaliningrad, Russia

Support to Brazilian Symposium on Remote Sensing (SBSR), Foz do Iguazu, Brazil

Nordic Meteorological Post-Graduate Education (NOMEK) training course, Vilnius, Lithuania

MAY
Workshop on advanced applications of remote sensing for marine forecasting and nowcasting, Casablanca, Morocco

JUNE
WMO-EUMETSAT training course on the use of satellite products for agrometeorological applications, Accra, Ghana

International remote sensing summer school, Bracciano, Italy

7th African Satellite Meteorology Training (ASMET) meeting, Nairobi, Kenya

JULY/AUGUST
EUMETSAT Satellite Application Course (ESAC) Training Course – online and classroom course, Nairobi, Kenya

Support to ASECNA training seminar addressing migration to new meteorological codes, Lome, Togo

Joint CALMet-EUMETCal Workshop, Toulouse, France

SEPTEMBER
20th WMO Symposium on Training and Education, Toulouse, France

Iberoamerican Training course on Satellite Meteorology, Montevideo, Uruguay

OCTOBER
Workshop on the Use of satellite data and products in studying and forecasting extreme weather events, Thessaloniki, Greece

EUMETSAT-CM SAF Training Workshop, Helsinki, Finland

NOVEMBER
SADCA (SAtellite Data access in Central Asia) project training course, Antalya, Turkey

The annual satellite course for West Africa, Niamey, Niger

DECEMBER
WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) course, Muscat, Oman

EUMETSAT Marine Course, Pretoria, South Africa

SUPPORTING AND EXPANDING THE USER BASE

CONTINUED

Mr Jeremiah Lengoasa (WMO), Dr Peng Zhang (CMA) National Satellite Meteorological Centre, Dr Michael Staudinger (ZAMG), Alain Ratier (EUMETSAT), Dr Phil Ardanuy (AMS), and Ernst Koenemann (EUMETSAT), at the 2013 EUMETSAT Meteorological Satellite Conference, Vienna, Austria, 16 September 2013

EUMETSAT FELLOWSHIPS AND VISITING SCIENTISTS

EUMETSAT's fellowship programme draws young, talented scientists into research on the use of satellite data, with the aim of consolidating the expertise and science base on the user side.

Four new fellows took up their duties in 2013, at the Norwegian Meteorological Institute, the Spanish State Meteorological Agency (AEMET) and the European Centre for Medium-Range Weather Forecasts (ECMWF).

Four new research topics were selected for fellows to be recruited in 2014:

- "Developing a Dynamic Infrared Emissivity Atlas Based on IASI Retrievals";
- "Investigating the Assimilation of Geostationary Water Vapour Radiance Data to Extract Wind Information with an Ensemble Kalman Filter";
- "Assimilation of Hyperspectral Infrared Radiances Using a Principal Component Analysis in a Convection Permitting Model"; and
- "Use of Satellite Soil Moisture Information for Nowcasting-Short Range NWP Forecasts".

EUMETSAT hosted visiting scientists from Europe, the United States, Japan and India and invited leading scientists and experts to give seminars to better inform staff on the value and use of EUMETSAT data. The first seminars were given by Prof. Sarah Jones, Director of Research at the Deutscher Wetterdienst (DWD), Dr Olivier Boucher, a senior climate researcher at the Institut Pierre Simon Laplace (IPSL) involved in the Fifth International Panel on Climate Change (IPCC) Assessment, and Prof Dr Erland Källen, Director of Research at ECMWF.

USER CONFERENCES

EUMETSAT AND THE AMERICAN METEOROLOGICAL SOCIETY JOIN FORCES IN VIENNA

The 2013 EUMETSAT Meteorological Satellite Conference and the 19th AMS Satellite Meteorology, Oceanography and Climatology Conference were held as one joint event in Vienna on 16-20 September. Supported by the Austrian Institute for Meteorology and Geodynamics (ZAMG) and the city of Vienna, the event attracted 509 participants from 45 countries, including 135 from the US.

The focus of the conference was water vapour, clouds and precipitation and the use of Earth observation systems to improve understanding and monitor trends and variability of the global hydrological system.

"Coffee talks" were organised at the EUMETSAT stand during the breaks to introduce new open web map services, the online ordering tool, guidelines for migration of EUMETCast user stations to the DVB-S2 standard and the use of MSG High-Rate Data Collection Platforms.

For the first time, a comprehensive online survey was conducted both before and after the event, to learn more about the participants,

"As a EUMETSAT Fellow at AEMET, I am working at the Atmospheric Observatory of Izana which is situated well above a stable inversion layer providing optimal conditions for validating infrared soundings of the atmosphere without interference by local pollution."

Sven Kuehl
EUMETSAT Fellow
AEMET, FTIR Remote Sensing

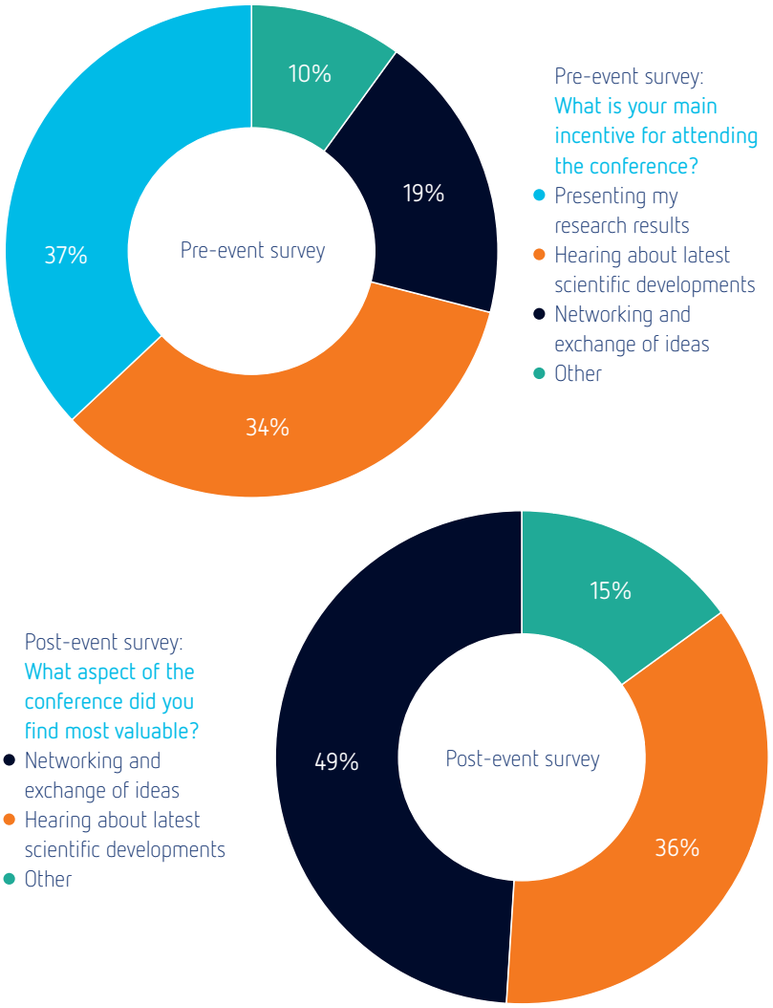
their motivation for attending and their satisfaction. Some 37% of the participants were first timers, more than 70% had attended three or fewer EUMETSAT conferences in the past and 6% had attended more than 10.

Before the conference, 19% of those surveyed stated their main incentive for attending was to network and exchange ideas with peers, and 49% indicated after the event that this had been paramount for them, showing that the conference exceeded initial expectations in this regard. Also, 34% of pre-conference respondents stated that their main motivation was to catch up on the latest scientific developments, which compares well with the 34% of participants who most appreciated attending particular sessions and 16% the wide range of scientific topics covered, thus confirming that the conference programme did meet expectations.

The first announcement for the 2014 EUMETSAT Satellite Conference, to take place on 22-29 September in Geneva, Switzerland, was distributed in Vienna.

EUMETSAT HOSTS THE INTERNATIONAL OCEAN COLOUR SCIENCE MEETING IN DARMSTADT

In the context of its preparation to exploit the Copernicus Sentinel-3 marine mission, EUMETSAT organised the International Ocean Colour Group Science Meeting in Darmstadt on 6-8 May, which attracted more than 270 scientists from 36 countries. At the meeting, the ocean colour scientific community established detailed requirements for ocean-colour products and services. (http://iocs.ioccg.org/).



Vienna conference survey results, pre-event (top) and post-event (bottom)

Participants at the first International Ocean Colour Science meeting, 6-8 May 2013, Darmstadt, Germany

SUPPORTING AND EXPANDING THE USER BASE

CONTINUED

EXTERNAL COMMUNICATIONS AND OUTREACH

A new version of the EUMETSAT web site was launched on 25 June, with new, improved functionality providing faster and easier access to the latest news and imagery. In addition, the web site hosts an online version of the Image newsletter - renamed InSight - now accessible to a wider audience.

EUMETSAT also increased its use of social media and outreach channels such as Facebook, Twitter, YouTube and Flickr to promote global awareness of EUMETSAT through regular posting of topical images and animations. Membership and subscriber numbers on Facebook, Twitter and YouTube all rose by more than 100% during the course of the year.

One image of Typhoon Haiyan uploaded to Flickr received over 105,000 views, caused a large spike in views of the EUMETSAT web site and was subsequently reused by news web sites all over the world. Following this devastating typhoon, the Staff Association Committee decided that donations from the EUMETSAT 2013 Christmas party would be offered to the "Hessen hilft den Philippinen" typhoon relief fund-raising campaign. The amount collected was sufficient to build two new houses in the typhoon-affected region, each suitable for a family of six, with enough money remaining to provide interest-free start-up loans to both families.

The Director-General and François Montagner, Chairman of the Staff Association Committee, presenting a cheque to Ralf Tepel, from the Karl Kübel Stiftung, on behalf of EUMETSAT employees, as a contribution to a typhoon relief fund-raising campaign

PROVIDING SUPPORT TO CAPACITY BUILDING INITIATIVES

In line with WMO strategy, EUMETSAT supports initiatives designed to further the use of satellite data in the periphery of Europe and in Africa, which is best observed by the Meteosat satellites. Activities include facilitation of real-time access to data through EUMETCast, training of trainers and users, and contributions to relevant capacity building projects, in particular those supported by Member States' National Meteorological Services and conducted by the European Development Fund (EDF) in cooperation with the African Union Commission.

SUPPORTING NMHSS OF NON-MEMBER STATES IN THE PERIPHERY OF EUROPE

An information day in Sarajevo on 4 April informed high-level representatives from Western Balkan countries' National Meteorological and Hydrological Services (NMHS) about the latest status of EUMETSAT products and services and discussed their planned use in the WMO-led project "Building Resilience to Disasters in Western Balkans and Turkey", funded by the EU Instrument for Pre-Accession Assistance. EUMETSAT presented its support to the project, focusing on training, nowcasting and upgrading EUMETCast stations.

A second information day was held in Baku, Azerbaijan, on 5 June, with the same objectives and format. It involved NMHS of Eastern European and Caucasian countries and those of the five beneficiary countries (Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan and Kyrgyzstan) of the SADCA (SAtellite Data access in Central Asia) project.

The SADCA project is being developed in cooperation with the Turkish State Meteorological Service (TSMS) to give operational access to EUMETSAT data in Central Asia through the installation of EUMETCast stations and training. At a "Train the SADCA trainer" workshop, EUMETSAT provided TSMS experts the information they need to install stations in beneficiary countries and to train local station administrators. After that, a joint training course using the SADCA reference station, equipped with the TSMS visualisation software, was conducted in Turkey for the beneficiaries, prior to the deployment of the stations.

"As it is project-oriented and leverages EUMETSAT programmes, our cooperation with Africa yields concrete contributions to the implementation of the Integrated African Strategy on Meteorology."

Vincent Gabaglio
International Relations Officer
EUMETSAT

COOPERATION WITH AFRICA

2013 was a crucial year for the smooth transition from the African Monitoring of the Environment for Sustainable Development (AMESD) project, which closed in June, and the follow-on Monitoring of Environment and Security in Africa (MESA) project, both funded by the European Development Fund.

On 4 July, EUMETSAT and the African Union Commission (AUC) signed a "Memorandum of Understanding on General Cooperation in the field of Earth Observation" and its "Implementing Arrangement on EUMETSAT's Contribution to the MESA Programme". In this framework, EUMETSAT supported the AUC's MESA technical assistance team in its evaluation of proposals submitted by the seven MESA Regional Implementation Centres and in the definition of requirements for training, maintenance and upgrading of EUMETCast stations.

EUMETSAT supported the fourth meeting of the WMO's Regional Association I (RA-I) Expert Group on EUMETCast Africa data dissemination, which also involved major European Numerical Weather Prediction (NWP) centres. EUMETSAT also began preparations for its 11th User Forum in Africa, which will be held in South Africa in September 2014.

The Task Team on Climate Services in Africa meets at EUMETSAT to discuss the implementation of the Addis Ababa declaration

Participants at the SADCA training course for forecasters, 7-11 October 2013, Ankara, Turkey

OPTIMUM DEPLOYMENT OF THE RECURRENT SATELLITES

The successful commissioning of Metop-B and Meteosat-10 has secured service continuity for the next five to seven years. But it is already time to prepare for the launches of MSG-4 and Metop-C, the last satellites in the series, to build the crucial bridge to the next generation MTG and EPS-SG systems.

METOP-B BECOMES THE PRIMARY METOP SATELLITE, AS PART OF A FULLY COMMISSIONED TWO-SATELLITE SYSTEM

In January, the Acceptance and Commissioning Handover Review confirmed that the EUMETSAT Polar System (EPS) and the operations team were ready for dual Metop operations. The in-orbit performance of Metop-B was found to be generally very good and comparable to that of Metop-A at the beginning of its life. The only significant anomaly recorded at that time, traced to a wrong connection of a cable during satellite integration, affected the command and receive antenna shared by the ARGOS and search and rescue receivers, causing the loss of 35% of the ARGOS beacon messages and 15% of search and rescue messages.

After this review, the Metop-B satellite was formally handed over to operations on 29 January and became the prime operational Metop satellite after completion of calibration and validation activities for level 1 products. Level 2 product calibration and validation activities were concluded on 22 July, ending the Metop-B commissioning activities. Finally, on 20 August, all Metop-B regional data services - EUMETSAT Advanced Retransmission Service-Advanced TIROS Operational Vertical Sounder (EARS-ATOVS), EARS-AVHRR (Advanced Very High Resolution Radiometer), EARS-ASCAT (Advanced Scatterometer), EARS-IASI (Infrared Atmospheric Sounding Interferometer) and EARS-NWC (nowcasting) services - became operational.

PLANNING FOR THE LAUNCH OF METOP-C IN 2018

In the first quarter of 2013, ESA and EUMETSAT consolidated the planning of Metop-C launch preparation activities, including reintegration of instruments (IASI and Microwave Humidity Sounder) removed from the satellite to fix known anomalies, and concluded related negotiations with industry.

The EPS-Metop-C ageing and storage review then assessed in more detail the risks associated with the last satellite in the Metop series. It took into account the preliminary assessment of the impact of two IASI anomalies found during the annual maintenance of the Metop-C payload module, one caused by delamination of motor magnets, as already observed on the MSG-4 Spinning Enhanced Visible and Infrared Imager (SEVIRI) calibration unit. As a result, additional activities were negotiated with Metop-C industry and captured in the consolidated contract approved by Council in November.

At the same November meeting, Council authorised proceeding with studies and the repair of the IASI instrument, as investigations of IASI anomalies concluded that neither the scan mechanism nor the corner cube mechanism motor were flightworthy and that repair work had to start immediately to preserve the targeted launch date of February 2018.

Another risk identified is the potential need to refurbish the Global Navigation Satellite System (GNSS) Receiver for Atmospheric Sounding (GRAS) instrument to cope with the phasing out of the Global Positioning System (GPS) code P(Y) after 2020 and its replacement by the new code L2C, if this change is confirmed in mid-2015 by the US government. Considering the need to decide the way forward by mid-2014, EUMETSAT recommended its Initial Joint Polar System (IJPS) partner, the National Oceanic and Atmospheric Administration (NOAA), ask for extended availability of code P(Y) until 2025 and initiated a detailed assessment with the European Centre for Medium-Range Weather Forecasts (ECMWF) and industry of the impact of the loss of Code P on the performance of the instrument and the feasibility of its refurbishment.

The Preliminary Mission Analysis for the Metop-C launch service performed by Arianespace concluded that a delta-review was needed to assess in detail some implications of the change of the launch site from Baikonur to Kourou. However, the European Space Agency's European Space Operations Centre (ESOC) confirmed that the existing network of ground stations could support safe Metop-C operations during the launch and early operation phase after launch from Kourou.

PREPARING MSG-4 FOR LAUNCH IN 2015 AND IN-ORBIT STORAGE

Launch preparation activities for the fourth and last Meteosat Second Generation satellite (MSG-4) mobilised the geostationary programme team immediately after the commissioning of Meteosat-10. This was necessary to implement Council's decision to launch the satellite in 2015, shortly after reintegration of its refurbished SEVIRI instrument, and to store it in orbit, to reduce technical and financial risks and save significant storage and destorage costs.

The refurbishment of one unit of the SEVIRI scan assembly, which was on the critical path, was successfully completed in February and the fully tested scan mechanism was shipped back to Astrium in June for reintegration on the SEVIRI instrument. In parallel, satellite integration and testing activities started, targeting readiness for launch in mid-February 2015, as negotiated with industry and the European Space Agency (ESA). Readiness to reintegrate the missing SEVIRI instrument was achieved before the summer break.

During satellite tests, a command failed to move the de-spin mirror of the Geostationary Earth Radiation Budget (GERB-4) instrument, similar to the GERB-3 in-orbit anomaly, and the instrument had to be dismounted and shipped to Rutherford Appleton Laboratory (RAL) for investigation. It was then established that changes to the on-board software and electronics of the instrument would reduce, or possibly eliminate, the risk of the mirror blocking in orbit, with no impact on the satellite preparation schedule.

Unfortunately, during preparations for the integration of the scan assembly into SEVIRI in early July, Astrium-F discovered corrosion and delamination of the coating of motor magnets inside the calibration unit of the instrument, similar to those observed on IASI/Metop-C. None of the spare motors available was flightworthy and, after trading off several recovery options, it was concluded in September that new magnets had to be procured and qualified by Astrium, leading to the decision to postpone the launch of MSG-4 from February to the summer of 2015.

The motor was equipped with new, qualified magnets and was integrated into the calibration unit in December, followed by the remounting of the latter on the SEVIRI instrument, which was scheduled for delivery to the satellite in February 2014. This, together with the latest schedule for the repair of GERB-4, is compatible with a launch in summer 2015.

The launch period of January to March 2015 initially agreed with Arianespace for the MSG-4 launch service was renegotiated for August to October 2015.

EUMETSAT system activities focused on the optimisation of the satellite configuration and commissioning activities for in-orbit storage, on the definition of the ground segment configuration required to monitor and control four MSG satellites in orbit, and on preparation of the launch and early orbit phase service provided by ESA/ESOC.

Internal studies concluded that the initial orbit inclination to be targeted by the launch service for minimising fuel usage during in-orbit storage was around 3.1°, different from the 1.8° targeted for MSG-2/3. A study was also kicked off with industry to define the in-orbit storage satellite configuration and maintenance strategy, for example, periodic SEVIRI activations, that would maximise satellite lifetime.

Other studies concluded that, despite the in-orbit storage, it was safer to have the same full scope for MSG-4 commissioning as for MSG-2/3, including early dissemination of imagery and products for a 2.5-month period of evaluation by National Meteorological Services and ECMWF.

The available ground segment station network was initially found sufficient to support the operations of four spacecraft, but after the collapse of the Meteosat-8 antenna in Usingen, it was necessary to accelerate the upgrade of the antenna available at the Fucino station to secure a suitable baseline for system testing in summer 2014.

MSG-4 satellite during integration at Thales Alenia Space (source: ESA)

NEW MANDATORY PROGRAMMES

A major milestone was passed in the development of the MTG system with the completion of the preliminary design phase, while further progress towards the approval of the EPS-SG programme was achieved, leading to the release of the Metop-SG invitation to tender by ESA.

As it is an operational agency, EUMETSAT must plan and develop now the future satellite systems it will need to deliver, and further improve observational inputs for forecasting and climate monitoring in the 2020-2040 timeframe. To achieve this, EUMETSAT relies on the successful cooperation model with the European Space Agency (ESA), which has made Europe a world leader in satellite meteorology, making best use of respective competencies. ESA is responsible for the development of satellites fulfilling user and system requirements defined by EUMETSAT and for the procurement of recurrent satellites on its behalf. EUMETSAT develops the ground systems required to deliver products and services to users and to respond to their evolving needs. It also procures all launch services and operates the full system for the benefit of users. European industry delivers the components of the system and supports its operations through contracts with ESA and EUMETSAT, capitalising on upstream European research and development.

METEOSAT THIRD GENERATION

The Meteosat Third Generation (MTG) programme was approved in June 2011. In the 2020-2040 timeframe, it will continue and enhance the services currently delivered by the Meteosat Second Generation series in support of nowcasting and very short-range forecasting of high impact weather over Europe, Africa and adjacent seas.

The MTG-I satellites will carry an innovative Lightning Imager instrument (artist's view) providing new information for nowcasting of severe weather, in particular in support of air traffic management

The MTG system will be the most complex geostationary system ever built. It will comprise two separate lines of satellites to be operated simultaneously. The MTG-I (imaging) line will significantly improve the Meteosat imagery mission and add a lightning imaging capability. The MTG-S (sounding) line, will, as a world premiere, implement a hyperspectral infrared sounding capability in geostationary orbit to deliver vertical profiles of temperature and moisture every 30 minutes over Europe. This infrared sounder will operate in synergy with the Copernicus Sentinel-4 ultraviolet sounder flown on the same spacecraft to 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.

In 2013, the MTG Programme Implementation Plan was signed with ESA, providing the management framework for the coordination of the respective contributions to the development of the MTG system, and all preliminary design reviews for the space segment were closed by ESA for the MTG-I satellite and its main Flexible Combined Imager (FCI) instrument, the MTG-S satellite and its infrared sounder and Sentinel-4 instruments, and their common platform.

The development of the MTG-I Lightning Imager also progressed significantly after the signature of the industrial contract between Thales Alenia Space and Selex ES, in February, with a successful instrument system requirements review.

The space segment development schedule was revised after these reviews, consistent with the launch of MTG-I1 by the end of 2018 and of MTG-S in early 2021, representing a six-month slippage against previous assumptions.

On this basis, EUMETSAT held its Delta System Preliminary Design Review to assess the consistency of the MTG system and ground segment design and plans with those of the space segment. The review was declared successful (subject to closure of important actions addressing, in particular, the consolidation of the Integration Verification and Validation plans), and authorised the EUMETSAT system and ground segment activities to enter their full development phase.

The review confirmed the soundness of the architecture and the maturity of requirements and plans for the ground segment required to support the MTG-I mission. Based on this, development started after Council approved the first ground segment facility contracts. Development of the Mission Operations Facility (MOF) and the Image Data Processing Facility for the imaging mission (IDPF-I) started in the last quarter. Two further invitations to tender were released, for the Telemetry Tracking and Control (TT&C) and Mission Data Acquisition (MDA) ground segment facilities. A phased procurement approach for the Level 2 Processing Facility (L2PF), was also approved by Council in November, addressing the different requirements and schedules of MTG-I and MTG-S in a cost effective manner, while providing the scalability and flexibility needed to cope with increasing processing demand and evolutions of algorithms.

Preparations for the launch services procurement for the MTG-I1, MTG-I2 and MTG-S1 satellites could also be initiated, following the Council decision to authorise direct negotiation with Arianespace while securing dual compatibility of all MTG satellites with Falcon launchers. Analyses involving ESA and industry then concluded that there was no obstacle to dual compatibility. The request for quotation to Arianespace will be released in 2014, after reassessment of the mass budgets of the MTG-I and MTG-S satellites by ESA and industry.

EPS SECOND GENERATION

The EUMETSAT Polar System Second Generation (EPS-SG) programme is the second pillar of EUMETSAT's future, and the European contribution to the Joint Polar System to be shared with the US (NOAA) in the 2020-2040 timeframe.

EPS-SG PAYLOAD COMPLEMENT AND TARGETED APPLICATIONS

EPS-SG SATELLITE-A MISSIONS	Instrument (and provider)	Predecessor on Metop	Applications benefitting
INFRARED ATMOSPHERIC SOUNDING (IAS)	IASI-NG (CNES)	IASI (CNES)	■ ■ ■ ■ ■
MICROWAVE SOUNDING (MWS)	MWS (ESA)	AMSU-A (NOAA) MHS (EUMETSAT)	■ ■ ■ ■
VISIBLE-INFRARED IMAGING (VII)	METIMAGE (DLR)	AVHRR (NOAA)	■ ■ ■ ■ ■ ■
RADIO OCCULTATION (RO)	RO (ESA)	GRAS (ESA)	■ ■
UV/VIS/NIR/SWIR SOUNDING (UVNS)	SENTINEL-5 (COPERNICUS, ESA)	GOME-2 (ESA)	■ ■ ■
MULTI-VIEWING, -CHANNEL, -POLARISATION IMAGING (3MI)	3MI (ESA)	-/-	■ ■ ■ ■

EPS-SG SATELLITE-B MISSIONS	Instrument (and provider)	Predecessor on Metop	Applications benefitting
SCATTEROMETER (SCA)	SCA (ESA)	ASCAT (ESA)	■ ■ ■ ■ ■ ■
RADIO OCCULTATION (RO)	RO #2 (ESA)	GRAS (ESA)	■ ■
MICROWAVE IMAGING FOR PRECIPITATION (MWI)	MWI (ESA)	-/-	■ ■ ■ ■ ■
ICE CLOUD IMAGER (ICI)	ICI (ESA)	-/-	■ ■ ■ ■
ADVANCED DATA COLLECTION SYSTEM (ADCS)	ARGOS-4 (CNES)	A-DCS (CNES)	■ ■

■ Atmospheric Chemistry
■ Climate Monitoring
■ Hydrology
■ Land
■ Nowcasting (NWC) at high latitudes
■ Numerical Weather Prediction (NWP)
■ Oceanography

NEW MANDATORY PROGRAMMES

CONTINUED

Artist's view of the rotating structure of the new Microwave Imager (MWI) instrument to be flown on the Metop-SG B satellites to map precipitation (source: industry)

Following the simultaneous entry into force of the EPS-SG Preparatory Programme and the ESA Metop-SG programme in November 2012, EUMETSAT activities focused first on the consolidation of user and system level requirements, given that these were expected by ESA as inputs to the Metop-SG satellite requirements review and, ultimately, to the invitation to tender for the procurement of the Metop-SG satellites.

A fast track mechanism was established to deliver critical system information to ESA as it became available, based on a split of the EUMETSAT System Requirements Review (SRR) into two parts. In June, part one of the review validated system inputs to ESA, following a critical reassessment of some requirements aimed at reducing EUMETSAT programme costs while fulfilling end user requirements. This led to proposals for some de-scoping and elimination of options, which were unanimously approved by Council in June, together with the End User Requirements Document.

This consolidated requirement baseline was propagated to ESA and captured by the Metop-SG initial satellite system requirements reviews, which concluded that design compliance of the Metop-SG satellites to applicable ISO 24113 debris mitigation regulations called for the addition of a controlled re-entry system. The impact on the satellite design was studied in a dedicated extension of the ESA Metop-SG Phase B1 studies, which confirmed in August that the proposed satellite configurations could be adapted without major impact, while preserving compatibility with a Soyuz-class launcher, despite the significant additional fuel required for controlled re-entry.

EUMETSAT then delivered final inputs to ESA and supported the consolidation of the Metop-SG ITT package, which could be released as planned on 17 September, allowing the start of bid evaluation before Christmas. Meanwhile, the contract for the development and procurement of the Infrared Atmospheric Sounding Interferometer-Next Generation (IASI-NG) instruments was signed by Astrium and CNES in October, in the presence of the French minister in charge of space and representatives of EUMETSAT, ESA and Météo-France. The latest design for the MetImage instrument was presented by the German Aerospace Centre (DLR) and industry in November.

After completion of all actions focused on the space segment, efforts towards achieving the 5% saving target on programme costs set by Council have concentrated on the ground segment and operations, capitalising on the work and recommendations of a dedicated EPS-SG Ground Segment Task Force established at the end of 2012. The task force assessed all opportunities and recommended measures for reducing the total cost of ownership of the ground segment by €35 million, using commonality and synergies across EUMETSAT programmes.

This was presented to and welcomed by Council in November, together with the elements of the EPS-SG Programme Proposal that were already available. The full programme proposal will be finalised after the selection of the Metop-SG prime contractors, to capture the space segment baseline and the associated cost to EUMETSAT, together with the system and ground segment design validated at the System Requirements Review part two.

The programme proposal will be submitted to Council in late spring 2014, so that the programme can be approved by the end of 2014, as is required to avoid any costly interruption of the industrial space segment development activities in 2015, at the end of the ESA Phase B2. In this perspective, the peer-reviewed study on the socio-economic benefits of the programme, published by the European Space Policy Institute (ESPI), was updated and delivered to Member States in December to support their approval processes. The study establishes that the benefit to cost ratio of the programme is in the order of 20.

OPERATIONAL OCEANOGRAPHY

EUMETSAT is preparing to operate the Jason-3 and Sentinel-3 ocean missions - both scheduled for launch in 2015 - in full synergy with its own missions. The resulting integrated data stream will give new impetus to Copernicus marine services and applications.

Only satellites can provide global observations of the physical and biological state of the ocean and the atmospheric parameters that drive its variability. The integration of their measurements of sea state and ocean surface wind, ocean topography and mean sea level, sea surface temperature, ocean colour, sea ice, incoming solar radiation and precipitation over the ocean with equally indispensable in situ observations from buoys, ships, ARGO floats, etc. and ocean modelling has heralded the era of operational oceanography.

HEADING FOR COMBINED JASON-3 AND SENTINEL-3 OPERATIONS IN 2015

EUMETSAT is involved in the development of two ocean missions, Jason-3 and Sentinel-3, both scheduled for launch in 2015, and is preparing for the operations of both systems on behalf of the European Union, under the Copernicus programme. The objective is to deliver the global, multi-mission marine data service required for the continuous development of operational oceanography in Europe.

Replacing the ageing Jason-2 satellite in 2015, Jason-3 will be implemented in partnership with NOAA, the French space agency (CNES) and NASA, with the support of ESA, and will continue to deliver the High Precision Ocean Altimeter (HPOA) mission. It will provide the reference for cross-calibrating ocean surface topography observations from Sentinel-3 and other altimeter missions and expand the unique mean sea level climate data record initiated in 1992 by Topex-Poseidon until 2020.

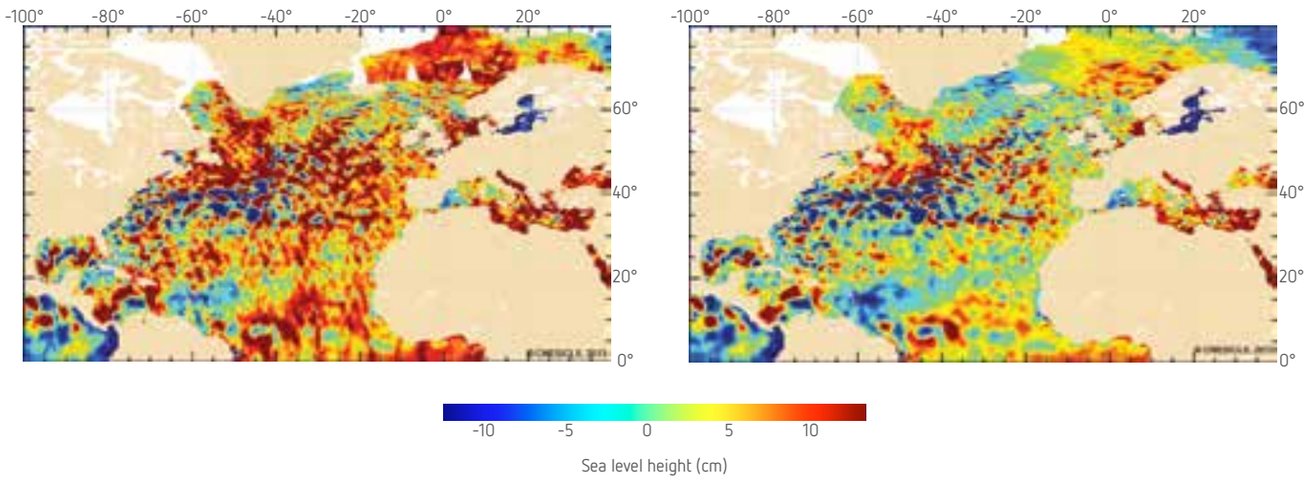
In addition to providing complementary altimeter measurements, Sentinel-3, developed by ESA and also scheduled for launch in 2015, will restart the series of highly accurate measurements of sea surface temperature and ocean colour which was interrupted after the loss of the ESA Envisat mission.

In 2013, EUMETSAT supported the integration and testing of the Sentinel-3 and Jason-3 systems and intensified its preparation for their combined operations.

After integration and health checks of all European and US instruments on the Jason-3 satellite, tests at satellite level led by CNES started in September. In parallel, EUMETSAT supported technical qualification tests of the four-partner ground segment which started in June, after confirmation of the full consistency of all elements and plans by the System Interface Review (SIR), and progressed as planned until the end of the year. The satellite and ground segment test programme is scheduled for completion in 2014 to achieve launch campaign readiness in the fourth quarter.

EUMETSAT's contribution to the ESA Sentinel-3 development programme continued in parallel, under a dedicated EUMETSAT third-party programme funded by Copernicus, focusing on the integration and early testing of the ground segment at EUMETSAT.

Maps of sea surface topography combining Jason-2 and Cryosat data (5 February 2013) showing the value of cross-calibration by the Jason reference mission. The cross-calibrated product (right) eliminates the artefacts visible in the uncalibrated product (left) to reveal all ocean circulation features sampled by the different orbits of both missions. (source: CLS/CNES)



OPERATIONAL OCEANOGRAPHY

CONTINUED

After the ground segment Critical Design Review led by ESA, completed in June, significant progress was achieved towards formal integration and testing of the Flight Operations Segment (FOS) required to control and exploit the Sentinel-3 satellites, the Payload Data Generation System (PDGS) for data processing and extraction of marine products and the upgraded EUMETSAT multi-mission ground systems, which together will form the EUMETSAT Sentinel-3 Marine Centre.

The Sentinel-3 control centre (FOS) implemented at EUMETSAT was used for the first successful connection test with the satellite telemetry and command simulator

The physical reality of the Sentinel-3 ground segment became visible to everyone at EUMETSAT after the control rooms were set up in the main building and their connection to the ground segment facilities installed in the Technical Infrastructure Building.

The hardware platforms for both the FOS facilities and the first version of the PDGS were installed in the Technical Infrastructure Building, and installation of software started. This enabled the first successful connection test between the FOS and the satellite telemetry and command simulator, and the implementation of a first version of the PDGS processing software converting satellite raw data into level 0 data usable for further processing. Preliminary versions of the upgraded EUMETSAT multi-mission dissemination systems were also delivered to support integration and testing of the full ground segment.

Preparation for the operation of the Sentinel-3A spacecraft and delivery of its marine mission, to be performed by EUMETSAT under a delegation agreement with the EU, implemented through a EUMETSAT Copernicus third-party programme, also progressed with the start of the production of the procedures, the release of the first issue of the ESA-EUMETSAT Sentinel-3 calibration and validation plan and the preparation of the ramp-up of the EUMETSAT operations teams.

JASON-CS: SECURING SERVICE CONTINUITY FOR COPERNICUS IN 2020

Jason-Continuity of Service (Jason-CS) is a proposed two-satellite programme required to continue the High Precision Ocean Altimeter mission after Jason-3, throughout the lifetime of the four planned Copernicus Sentinel-3 satellites.

Building on the heritage of previous cooperation and programmes, it involves Europe and the United States. EUMETSAT, ESA and the European Union are involved on the European side, through the combination of an ESA programme covering the development of the first satellite, a EUMETSAT optional programme covering, among other things, the development of the ground segment, and the EU Copernicus programme covering operations and co-funding the recurrent satellite with EUMETSAT. On the US side, NOAA will deliver instruments, launch services and provide support to operations.

The definition of the programme progressed in cooperation with ESA, NOAA, NASA and CNES, based on the heritage of Jason-3 and of the ESA Cryosat mission.

After the Satellite Design Review concluding the ESA-led phase B1 study, a satellite and payload baseline was presented to and endorsed by the first meeting of the Potential Participating States in the EUMETSAT Jason-CS programme, in April. It includes a US-provided radio occultation instrument and an innovative interleaved operation mode for the altimeter, which best fulfils the continuity with previous Jason missions while sampling mid-latitude eddies at much higher resolution to achieve the best possible synergy with the Copernicus Sentinel-3 mission.

In the second half of the year, EUMETSAT system and ground segment design activities progressed towards the System Requirement Review part 1 (SRR-1) planned for the beginning of 2014. A revised draft End User Requirements Document aligned with the agreed satellite baseline was produced and endorsed in December by the second meeting of Potential Participating States. The meeting also supported the renaming of the mission as Sentinel-6, as proposed by the European Commission, and welcomed documents on expected programme benefits highlighting unique contributions to operational oceanography, weather and seasonal forecasts, marine meteorology and climate monitoring.

COOPERATION WITH OTHER SATELLITE OPERATORS

By cooperating with other satellite operators, EUMETSAT makes its data available to a wider user community and gains access to additional data, thus enhancing the benefits to its Member States and its value to the WMO Integrated Global Observing System. Important new agreements with the US, China, India and Russia were signed or prepared in 2013.

MULTILATERAL COOPERATION WITHIN CGMS

The Coordination Group for Meteorological Satellites (CGMS) is a forum in which operators of meteorological satellites and other space agencies harmonise their plans and activities to support operational weather and climate monitoring from space in response to requirements of the World Meteorological Organisation.

CGMS coordinates the satellite systems of its members in an end-to-end perspective, including protection of in-orbit assets, shared access to and use of satellite data and products in various applications, for the benefit of users around the world.

The 41st plenary session hosted by JMA and JAXA in Tsukuba, Japan, on 8-12 July, agreed the proposed terms of reference of a new working group on climate shared with the Committee on Earth Observation Satellites (CEOS). CGMS also discussed the benefits of moving one meteorological polar-orbiting satellite to the unpopulated "early morning" orbit, as demonstrated by studies performed by ECMWF, the Met Office (UK), DWD, JMA, NOAA and the China Meteorological Administration presented at a dedicated workshop in Beijing in April. The move would support the implementation of Vision 2025 of the space component of the WMO Integrated Global Observing System (WIGOS). CMA informed CGMS on preliminary studies made on this matter.

Participants in the 41st plenary session of CGMS in Tsukuba, Japan

COOPERATION WITH OTHER SATELLITE OPERATORS

CONTINUED

BILATERAL COOPERATION

On 27 August, the Director-General signed a Long-term Cooperation Agreement with the US National Oceanic and Atmospheric Administration's (NOAA) newly nominated Administrator, Dr Kathy Sullivan. The agreement provides the policy framework for the continuation and expansion of the successful strategic cooperation between both agencies, which already share the Initial Joint Polar System (IJPS) and are operational partners in the Jason programmes. The signing took place at the EU Delegation in Washington, DC, highlighting the value of cooperation to both Europe and the US. It followed a keynote speech by the Director of the European Space Policy Institute (ESPI) on the benefits of NOAA-EUMETSAT cooperation, based on a study by ESPI.

Within this policy framework, discussions progressed on the draft Joint Polar System (JPS) agreement addressing the articulation of the NOAA Joint Polar Satellite System (JPSS) and the EUMETSAT Polar System Second Generation (EPS-SG) programmes, including the sharing of ground infrastructure in Spitzbergen and Antarctica. Also discussed were preparations of the Jason-CS programme and the continuation of the GEONETCast data dissemination infrastructure coordinated with China in the context of the Group on Earth Observations (GEO).

Signature of EUMETSAT-NOAA Long-term Cooperation Agreement by Alain Ratier and Dr Kathy Sullivan at the EU Delegation in Washington, DC

On the operational aspects of the cooperation, the transition to operational status of the NOAA Suomi NPP global data service created excellent conditions for access to and redistribution of data to European users. A teleconference just before the US government shutdown was essential to confirm that all critical operational cross-support was secured in such exceptional circumstances, including continuity of the collision avoidance service provided to EUMETSAT by the US Department of Defence.

Council agreed, along with the four Jason-2 programme partners - NOAA, EUMETSAT, CNES and NASA - to extend the mission until the end of 2017. NOAA also confirmed its commitment to contribute to the follow-on Jason-3 programme, including funding of the launch service.

EUMETSAT signed a memorandum of understanding with NASA, the other US partner in the Jason programme, on its participation in the Global Precipitation Measurement Mission (GPM) on 26 July.

A new agreement was signed with the China Meteorological Administration on 27 June during the 78th Council session. The agreement gives a more strategic dimension to the cooperation by addressing coordination of the respective polar-orbiting and geostationary missions in the context of WMO and CGMS, as well as data exchange and scientific cooperation.

On the operational side, data from the FY-3B satellite's microwave imager became routinely available to EUMETSAT and were redistributed as a third-party data service, enriching the EUMETSAT portfolio of precipitation products.

There was significant progress in the implementation of the cooperation agreement with the Chinese State Ocean Administration following a joint scientific and technical workshop held in Darmstadt in June. The workshop also involved the European Centre for Medium-Range Weather Forecasts (ECMWF), MyOcean and the Ocean and Sea Ice Satellite Application Facility (OSI SAF) and focused on processing, calibration and validation of HY-2A scatterometer, ocean colour, sea surface temperature and altimeter data, and on near-real-time access for assimilation into weather and ocean models. China's National Satellite Ocean Application Service and EUMETSAT then exchanged data samples, prepared their operational exchange and agreed the specification of the first EUMETSAT HY-2A third-party data service approved by Council in November.

The renewed cooperation agreement with the Indian Space Research Organisation (ISRO) was prepared and authorised for signature by Council and the Indian government in December. Cooperation activities planned within this framework include cross-calibration between measurements collected by Meteosat-7, the Metop IASI sounder and the INSAT-3D satellite launched by ISRO in June. Positioned at 82° East, INSAT-3D is being considered as one potential contributor to the continuation of an Indian Ocean Data Coverage (IODC) service to be shared by CGMS operators after the de-orbiting of Meteosat-7 in 2017. An ISRO scientist visited EUMETSAT to prepare joint work on processing data from radio occultation instruments flown on Indian satellites (Megha-Tropiques and Oceansat-2), leading to a joint presentation to the annual meeting of the CGMS "International Radio Occultation Working Group" held on 5-11 September in Graz, Austria.

Trilateral cooperation between ISRO, EUMETSAT and CNES on ocean altimetry delivered its first benefits to users in 2013 with the start of real-time dissemination of altimeter products from the SARAL satellite launched by ISRO on 25 February, after full validation of the EUMETSAT ground segment elements. EUMETSAT and CNES also implemented the network connectivity and software needed to acquire and reformat the data from Megha-Tropiques' SAPHIR microwave instrument.

At a bilateral meeting held in October in Moscow, Roshydromet and EUMETSAT agreed to prepare an extension of their cooperation agreement on exchange of data, training and science beyond 2014. The priorities for the Russian contributions to the EUMETSAT Advanced Retransmission Service (EARS) network were agreed such that Metop-A processing could start at the Moscow EARS station in December, using new servers and software delivered by EUMETSAT. Another important joint milestone was the start of real-time dissemination of imagery from the Russian Electro-L N1 geostationary spacecraft via EUMETCast.

A bilateral meeting with the Japan Meteorological Agency took place in July in Tokyo, where both agencies agreed to further cooperation on algorithm and software development for extracting wind and volcanic ash products from geostationary observations and on intercalibration and reprocessing for climate monitoring applications, as well as on a longer-term scheme for exchanging visiting scientists.

During the same week, at a bilateral meeting with the Japan Aerospace Exploration Agency (JAXA), EUMETSAT was granted the status of special user of GCOM-W1 data and thus authorised to directly access and redistribute data to the national meteorological services of its Member and Cooperating States and to ECMWF. In return, EUMETSAT agreed to establish a mechanism to provide user feedback to JAXA on the usage, quality and impact of data. JAXA and EUMETSAT also coordinated their plans for their successive chairmanships of CEOS.

Signature of EUMETSAT-CMA Cooperation Agreement by Alain Ratier and Dr Jun Yang, Director-General of the National Meteorological Satellite Centre, during the 78th Council session, in the presence of Prof Petteri Taalas, Council Chairman

EUMETSAT and the Korea Meteorological Agency (KMA) met in Seoul, on the return journey from CGMS-41, to review progress in their cooperation on data exchange and tailoring of SAF nowcasting software to process data from the Korean GOMS geostationary satellite. This was followed by the 2nd KMA-NWC SAF workshop held in Vienna on 18 September, on the margins of the EUMETSAT Meteorological Satellite Conference. A project was also established with KMA to assess terrestrial multicasting of some EUMETSAT data to the Asia-Pacific region using the GEANT high speed network.

EUROPEAN AND GLOBAL PARTNERSHIPS

In 2013, EUMETSAT secured its role in Copernicus and prepared for a related delegation agreement with the EU. At the same time, it supported the implementation of the architecture for climate monitoring from space and the international Charter for Space and Disasters.

"With EUMETSAT, the European Commission has a trusted and experienced partner to ensure the take-off of Copernicus."

Dr Paul Weissenberg
Deputy Director-General
European Commission DG Enterprise and Industry

EUROPEAN SPACE POLICY AND COPERNICUS

The Lisbon Treaty made space a shared competence between the European Union (EU) and its Member States. Copernicus is one of the EU's flagship programmes.

"Copernicus, the EU Earth Observation programme, should ensure an autonomous Union capacity for space-borne observations and provide operational services in the field of atmosphere monitoring, marine monitoring, land monitoring, climate change monitoring, emergency management, and security. It should also make use of the available contributing missions and in situ data provided, mainly by the Member States."

The successful implementation of the Copernicus services for monitoring the ocean, the composition of the atmosphere and climate change calls for maximum synergy with operational meteorology, capitalising in particular on the investments already made in space infrastructure by the EUMETSAT Member States. This was the rationale for the decision to implement the Copernicus Sentinel-4 and Sentinel-5 atmospheric composition monitoring missions within the EUMETSAT Meteosat Third Generation and EPS Second Generation satellite systems, based on additional sounding instruments, and to select EUMETSAT as the operator of the Sentinel-3 and High Precision Ocean Altimetry (HPOA) Copernicus marine missions, Jason-3 and Jason-CS.

2013 was decisive for the scoping of EUMETSAT's role in support of Copernicus, for its recognition by the Copernicus stakeholders and for internal preparatory activities.

Addressing the 5th EU Space Policy conference in January, the Director-General stressed that EUMETSAT, as a user-governed operational satellite agency, should be more than just the operator of ground systems developed with ESA. Its ambition is to deliver end-to-end data services to Copernicus marine, atmosphere and climate services on behalf of the European Union and to manage interactions with service providers and users, as it does for its own missions. In so doing, one of EUMETSAT's main goals is to disseminate integrated data streams combining its own data, relevant Copernicus data and data from third-party agencies, to create unique data synergies and offer the broadest possible spectrum of opportunities to users, in particular in the areas of marine and air quality applications.

While discussions in Brussels on approval of the EU Multi-annual Financial Framework 2014-2020, including a Copernicus budget, concluded on 18 November, the role of EUMETSAT was increasingly recognised in the discussions on the draft regulation establishing the Copernicus programme. This was confirmed in December by the compromise text supported by the EU Council, the European Commission (EC) and the European Parliament, which foresees a delegation agreement with EUMETSAT.

EUMETSAT and the EC started to discuss the contents of a possible delegation agreement and of the corresponding third-party programme providing the necessary EUMETSAT legal framework. This included trilateral meetings also involving ESA to define the coordination mechanisms needed between both agencies to implement their respective contributions to Sentinel-3 operations.

The outcome was a preliminary proposal for a EUMETSAT third-party programme covering support to Copernicus which was unanimously approved by the Council in June, thus confirming that the proposed activities, split into five clear building blocks, comply with the EUMETSAT Convention.

The first two building blocks address operations and delivery of operational data and support services for the Copernicus marine and atmosphere monitoring services and their users as part of the Copernicus Space Component. The third block offers the EU the possibility to continue to use EUMETCast and other existing EUMETSAT dissemination channels to broadcast selected third-party data or Copernicus information to users, as it already does for information from the global component of the Copernicus Land Service and some products from the US Suomi NPP satellite.

The fourth and fifth blocks cover EUMETSAT's support to the future Copernicus climate change monitoring service and to the definition by the EU of requirements relevant to future Copernicus marine and atmosphere services. This follows up on the EU-funded GMES-PURE (Partnership for User Requirements Evaluation) project led by EUMETSAT and kicked off on 17 January.

In the second half of 2013, an internal Copernicus task force was set up to prepare the organisation of Copernicus activities. Its initial focus was the response to the "four-pillar" audit commissioned by the EC to assess the compliance of the EUMETSAT management system with the requirements of a delegation agreement. An action plan was delivered addressing all recommendations of the draft audit report.

Special attention was then paid to the mitigation of risks associated with early Copernicus activities that need to start in 2014, shortly after the entry into force of the delegation agreement. This included a proposal to Council to initiate a procurement process for the ramp-up of the Sentinel-3 operations team, offering a contractual framework to the EU in July 2014 that would avoid a mechanical six-month delay and additional costs to Copernicus.

The 78th Council session approved a preliminary proposal for a third-party programme covering EUMETSAT activities in support of Copernicus

In the context of the EU-USA Dialogue on the use of civil space, EUMETSAT supported the EC in discussions on Sentinel data policy and data exchange, and proposed, in cooperation with NOAA, to provide real-time access to selected marine and atmosphere products extracted from observations from the US Suomi NPP satellite to the current Copernicus pre-operational marine and atmosphere services (MyOcean2 and MACC II). After positive evaluation, the project, named SNPP4C, was approved for funding by the GMES Initial Operations (GIO) programme and the grant agreement was signed on 16 December.

In other areas of the European Space Policy, EUMETSAT participated in the 15th European Inter-parliamentary Space Conference organised in Brussels by the Belgian presidency of the Inter-parliamentary Space Group and was authorised by its Council to sign the declaration of intent between ESA and the European customers of European launch services to ensure that the requirements of the organisation are captured in the definition of future European launchers.

EUMETSAT also coordinated its work on frequency protection with ESA, the EC, national space agencies, EUMETNET and WMO to protect the use of vital frequencies, in particular for the continued exploitation of microwave passive and active Earth observation sensors (C-band radars) that may be threatened by increasing bandwidth claims of Wide Area Network (WAN) applications.

EUROPEAN AND GLOBAL PARTNERSHIPS

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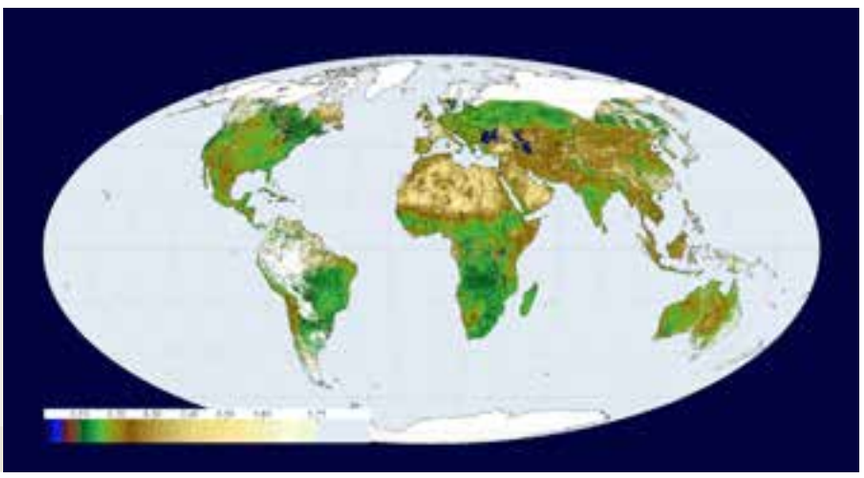


Climatology of surface albedo established in the framework of the SCOPE-CM international project using historical data from the full "ring" of geostationary meteorological satellites (source: SCOPE-CM)

ARCHITECTURE FOR CLIMATE MONITORING

Under the Global Framework for Climate Services (GFCS), EUMETSAT participated in a "Dialogue on Practical Action on Operational Climate Services" panel in Geneva to introduce the 1st Intergovernmental Board for Climate Services and address the practical benefits of an organised system for operational climate services and all the activities required to deliver such services.

Following the inclusion of the Addis Ababa Declaration in the Integrated African Strategy on Meteorology (climate and weather services), EUMETSAT facilitated discussions among the signatories in close coordination with WMO, supporting a task team set up to create the conditions for the development of regional African Climate Services, involving the African Regional Economic Communities, the African Union Commission, the African, Caribbean and Pacific Group of States (ACP) Secretariat, WMO and the African Regional Climate Centres.

As one component of the observation and monitoring pillar of the GFCS, the Architecture for Climate Monitoring from Space has established a first inventory of Climate Data Records for Essential Climate Variables showing that EUMETSAT and its Satellite Application Facility (SAF) network provide approximately 29% of the entries.

To coordinate the sustained development of the architecture, EUMETSAT proposed to CEOS and CGMS to set up a joint climate working group. The terms of reference were endorsed by the CGMS and CEOS plenary meetings and assign three main objectives to the group:

(i.) to provide visibility on the Climate Data Records currently available from satellite missions of CEOS and CGMS agencies or their combination,
(ii.) to create the conditions for delivering further Climate Data Records, to fulfil Global Climate Observing System (GCOS) requirements, and
(iii.) to optimise the planning of future satellite missions and constellations to expand existing and planned Climate Data Records, and to close possible gaps with respect to GCOS requirements.

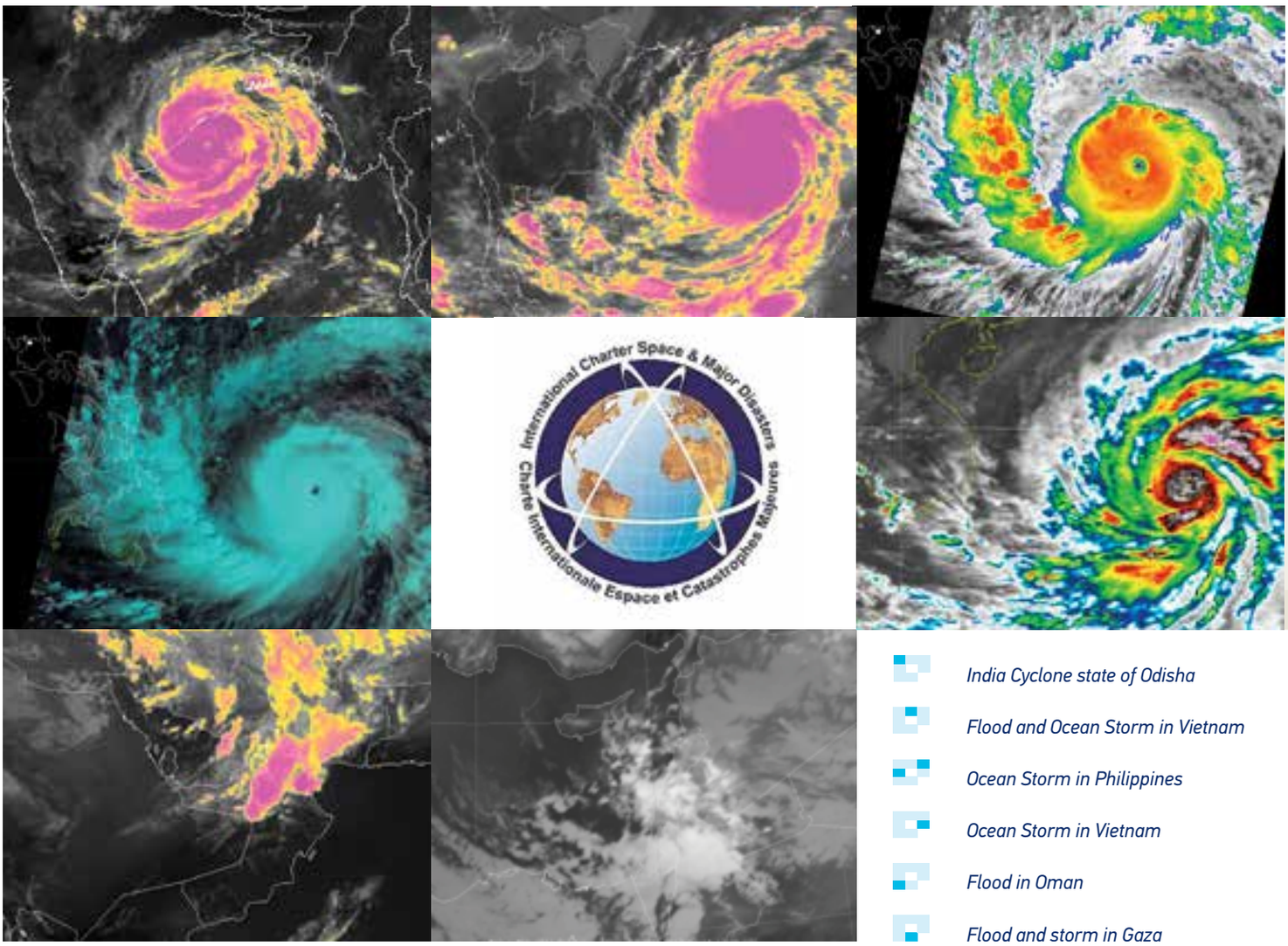
Last but not least, EUMETSAT and the World Climate Research Programme agreed to organise, with the support of the European Commission, an international symposium on "Climate research and Earth observation from space: climate information for decision-making". The event will build on the publication of the 5th International Panel on Climate Change (IPCC) Assessment Report and will be held in Darmstadt on 13-17 October 2014 during the EUMETSAT CEOS chairmanship. The second announcement, including the final programme and call for papers, was published in December, and a dedicated web site was opened (www.theclimatesymposium.com).

CEOS AND GEO

In November, EUMETSAT participated in the plenary session of CEOS in Montreal and took over the annual CEOS chairmanship from the Canadian Space Agency (CSA) on that occasion.

The EUMETSAT chairmanship will focus on the implementation of the new governance agreed in Montreal as a result of a CEOS self study performed under NASA's leadership and on the climate agenda.

EUMETSAT has continued to contribute to GEONetCast through EU-funded projects in support of the GMES Initial Operations (GIO) Global Land programme and the Framework Project (FP7) AGRICAB and SIGMA projects. Data exchanged between NOAA, CMA and EUMETSAT have continued to be disseminated on CMACast and EUMETCast. In July, the



India Cyclone state of Odisha

Flood and Ocean Storm in Vietnam

Ocean Storm in Philippines

Ocean Storm in Vietnam

Flood in Oman

Flood and storm in Gaza

Meteosat imagery of devastating cyclones and storms delivered by EUMETSAT in support of the activations of the Charter on Space and Major Disasters to the benefit of India, Philippines, Vietnam, Cambodia, Oman and Gaza

Australian Weather Bureau (BoM) became the first institutional user of the EUMETSAT data stream disseminated by CMACast.

EUMETSAT prepared its participation in the 10th Plenary Session of the Group on Earth Observations (GEO-X) and the GEO Ministerial Summit to be hosted by Switzerland, in January 2014, where it also represented CEOS. This included support to a GEO showcase on capacity building in Africa and a dedicated booth and side-event organised in cooperation with NOAA, CMA and WMO to promote GEONetCast and its contribution to the international Charter on Space and Major Disasters.

INTERNATIONAL CHARTER 'SPACE AND MAJOR DISASTERS'

EUMETSAT was formally declared operationally qualified by the Board of the Charter on Space and Major Disasters on 22 November. This opened the possibility of using EUMETCast for real-time delivery of satellite imagery and products from EUMETSAT and other Charter partners in the event of Charter activations.

This also qualified the quasi-global GEONETCast dissemination system coordinated by CMA, NOAA and EUMETSAT. This system was used by EUMETSAT to provide Meteosat-7 imagery in response to Charter activations relating to typhoons Phailin and Nari, which caused major damage and floods in India, Vietnam, Cambodia, Oman and Gaza.

MANAGEMENT

As part of its commitment to continuous improvement in a changing environment, EUMETSAT established a new matrix organisation, achieved full compliance with international accounting standards and started to implement a new internal audit function.

EUMETSAT FEELS FIRST BENEFITS FROM REORGANISATION PROJECT

With the closing of the Forward 2020 (FWD2020) project in June, EUMETSAT moved to a full matrix organisation in which a new Technical and Scientific Support (TSS) Department, organised by competencies, delivers scientific, engineering and management support to operations and development programmes. This allows for better integration of scientific and engineering expertise and more flexibility for reallocating human resources across operations and development activities.

All arrangements were established for the different types of support provided by the TSS Department - service level agreements to support operations, delegated development tasks and integrated support to development programmes - and subjected to internal audits to make sure key processes had been properly implemented, in particular in the area of operations. This was confirmed in November by the successful ISO 9001:2008 surveillance audit focused on the reorganisation.

In the second half of 2013, the emphasis shifted to realising the first benefits of the new organisation and preparing for more in the coming years.

The integration of all scientific expertise into a single Remote Sensing and Products Division established the critical mass needed to establish a four-year plan addressing development and operational implementation of new products across programmes, structured by expertise area and no longer by programmes, to facilitate ownership by teams of scientists. Likewise, the clarification of responsibilities for climate services allowed the definition of a first multi-annual Climate Services Development Plan (CSDP).

The grouping of management support functions (quality assurance, configuration management, document management and project control) into a single Process Assurance and Management Support Division enabled work to start to harmonise processes and support tools across the organisation.

The detailed implementation of the new organisation will continue to require efforts under the leadership of a fully renewed management board and will be subject to internal audits to create a sound basis for the ISO 9001:2012 recertification audit planned at the end of 2014.

In September, the Communication and Information Services Division in charge of internal and external communication was transferred from Administration to the office of the Director-General and relocated into an environment facilitating interactions with that office, as well as with the Chief Scientist and the Head of Strategy and International Relations.

FINANCIAL PROCESSES

The budget preparation, human resource and financial planning processes were adapted to the new matrix organisation.

The Annual Accounts 2012 were presented in March to the External Auditors, who concluded their audit with an unqualified opinion, noting that the 2012 financial statements were fully compliant with International Public Sector Accounting Standards (IPSAS), thus bringing the IPSAS implementation project to a successful close.

The full actuarial review of the EUMETSAT special pension account showed coverage of liabilities at a level of 79%, which represents a relatively satisfactory situation considering the impact of the economic crisis.

Preparation of the draft budgets and financial planning was particularly complex in 2013 due to the substantial impact of unforeseen events

"Our IPSAS project was successfully closed in 2013, with the publication of our first fully compliant financial statements. It was rewarding to see that the adoption of these accounting standards proved to be essential for the eligibility of EUMETSAT for Copernicus tasks delegated by the European Union."

Caroline Collet
Head of Accounting Section
EUMETSAT

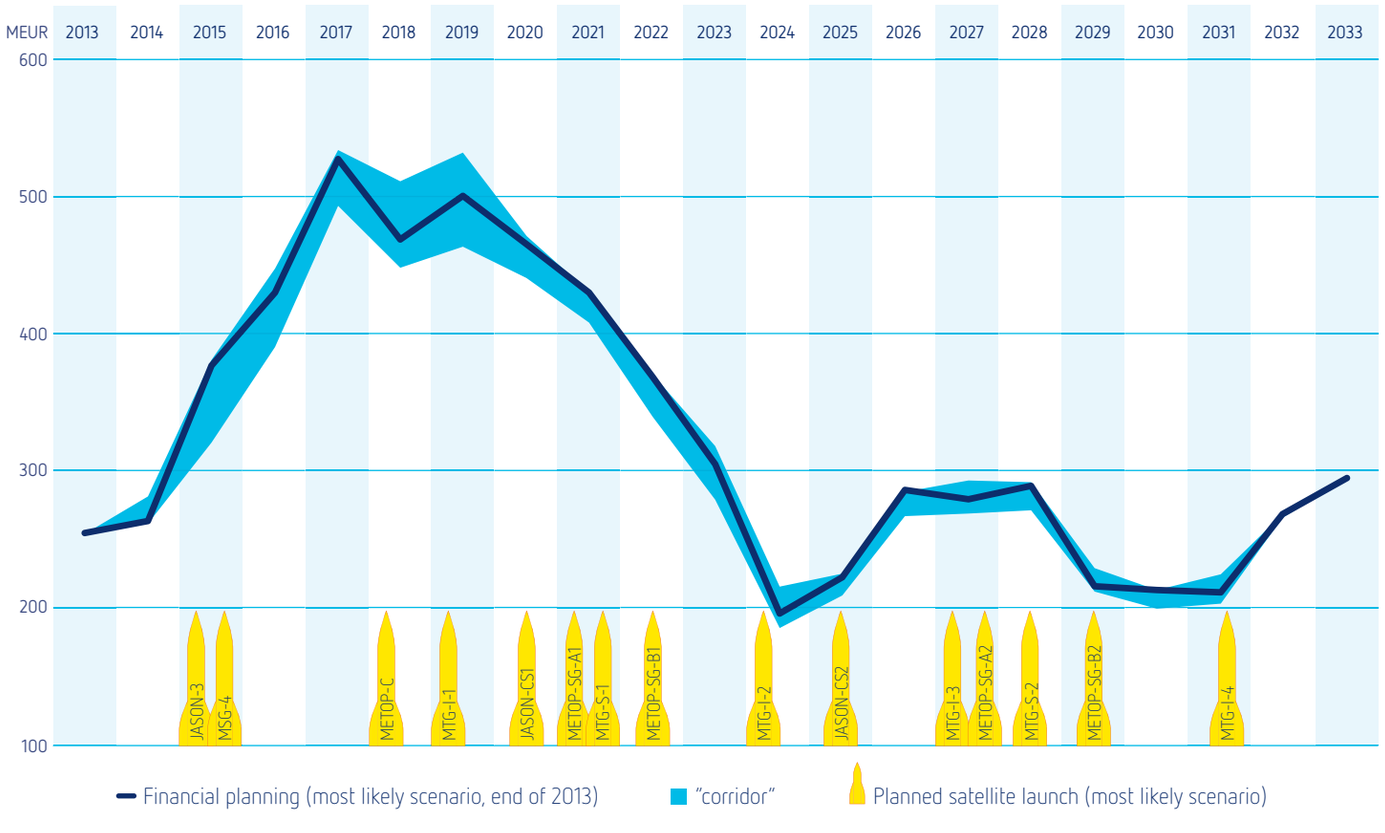
which became known only in September - i.e. the postponement of the MSG-4 launch and the need to repair the Metop-C IASI instrument - and the requirement to establish the first budget and planning for the foreseen EU-funded third-party programme covering EUMETSAT's support to Copernicus.

The previously separate 10-year and 20-year financial plans were integrated into a single document also addressing the additional financial requirements of extended operations of existing satellites needed to bridge the gap to next generation systems. The revised financial planning reflects the postponement of MTG expenditure to future years, the six-month slippage of the MSG-4 launch and a revised financial profile established with ESA for the EUMETSAT Polar System Second Generation (EPS-SG) programme. This will lead to lower contributions than previously anticipated in 2014-2016, offset by higher contributions in the years 2017-2020.

PROCUREMENT PROCESS

Some aspects of the EUMETSAT procurement procedures were revised following an internal review by the new Head of Contracts and

FINANCIAL PLANNING (CONTRIBUTIONS) 2013-2033



The promotion of Silvia Castañer to become Director of Administration and the recruitment of Eleni Katsampani as Head of Contracts shows EUMETSAT's commitment to equal opportunity

to ensure equivalence to EU procurement rules in response to the four-pillar audit commissioned by the EC to assess EUMETSAT eligibility for a Copernicus delegation agreement.

Following initial changes in 2012, EUMETSAT tightened its procurement policy for the consultancy workforce so that it is contracted only from consultancy companies that are duly certified as employers and no longer directly from individuals.

Industry days were held in Zurich on 7 June and Vienna on 17 September, followed by a meeting of industrial focal points held at EUMETSAT on 2 October.

CONTRACT PROPOSALS AND FINANCIAL AGREEMENTS APPROVED BY COUNCIL IN 2013

- User service support
- Extension of EUMETCast Americas data dissemination service for the period 2014-2015
- EUMETCast Europe: satellite data dissemination service
- EUMETCast Europe: data uplink service
- Exercising of contract option to extend Meteosat Operations Controller Team until end of 2015
- Extension of MTP Back-up Ground Station Service
- Extension of MTP Primary Ground Station Maintenance Service
- Extension of MSG Primary Ground Station Maintenance Service
- Extension of MSG Foreign Satellite Data Support Service
- Extension of non-exclusive Permanent Supplier of Storage Area Network Equipment
- Preparation of the MSG-4 satellite for launch and launch campaign activities
- Preparation of the Metop-C satellite for launch
- Replacement of the QBS2 of the Metop-C Microwave Humidity Sounder (MHS) instrument
- Authorisation to Proceed with the repair of the Metop-C Infrared Atmospheric Sounding Interferometer (IASI) instrument for Metop-C
- Development of the first version of the Instrument Data Processing Facility (IDPF-I) of the Meteosat Third Generation ground segment
- Development of the Mission Operations Facility (MOF) of the Meteosat Third Generation ground segment
- Extension of rental services for external office space
- Construction of new office building with a canteen
- Extension of catering services until 30 September 2015

HUMAN RESOURCES MANAGEMENT

EUMETSAT recruited its first female Director of Administration, Ms Silvia Castañer, and Head of Contracts, Ms Eleni Katsampani, demonstrating the effectiveness of its equal opportunity policy. Council also decided to recognise registered partnerships with legal validity in Member States in order to align the EUMETSAT Staff Rules to applicable national legislation.

The travel policy was enhanced to include specific guidance to staff travelling on mission to non-OECD countries, where they can be exposed to specific health and safety risks. The training policy was also enhanced to address the development of system engineering and other skills that are critical to EUMETSAT business, take a long time to build up and are difficult to acquire through external recruitment.

Demographic analyses were performed showing that, while the population of administrative staff is fairly young, EUMETSAT engineers have an average age of close to 50 with an upward trend, which represents a significant risk for a small organisation like EUMETSAT entering a new cycle of demanding development programmes and investments expected to last more than 10 years. Human resource policy measures addressing these risks are under consideration.

The web pages addressing job vacancies were redesigned to better inform job seekers about EUMETSAT human resource policies, living in Germany and social activities organised by the Staff Association Committee, based on testimonial videos involving staff members, and to give early indications of planned recruitment in addition to already open vacancies.

GENERAL INFRASTRUCTURE AND SERVICES

A new office accommodation plan was fully implemented - 335 office moves in 10 weeks - to optimise the use of space available for the period 2013-2015 in the main building and rented nearby until the New Office Building becomes available. The more restrictive office space standard applicable in Germany, the latest human resource planning and the need to regroup personnel to realise the synergies created by the new organisation and to bring scientists closer to where data is generated, were taken into account.

Meanwhile, preparations were made for the construction of the New Office Building, which is needed from 2015 to accommodate

the workforce involved in the development of the future EPS-SG satellite system. It will include 160 work positions and a new canteen. Leonhard Weiss GmbH was selected as the general contractor and all arrangements required to make the additional piece of land available were finalised with the German authorities so that construction work could start in January 2014.

In the area of information technology (ICT) services, all work stations were migrated to Windows, a new firewall was installed and a new version of the document management software was rolled out.

The New Office Building will include 160 workplaces and a new canteen

QUALITY MANAGEMENT

The ISO 9001:2008 surveillance audit performed by Deutsche Gesellschaft zur Zertifizierung von Managementsystemen (DQS Germany), focused on the implementation of the new organisation, was declared successful in November, confirming EUMETSAT's full compliance with ISO 9001:2008 requirements.

INTERNAL CONTROL AND RISK MANAGEMENT

The new internal control framework entered into force in June, after Council's approval of relevant amendments to the Financial Rules. It combines ex ante controls split between line management and the financial control function with a new internal audit function. The internal audit and the financial control offices were grouped in the same building area to facilitate interactions and exchange of information.

The detailed definition of the internal audit function was finalised with the publication of the internal audit charter, and its full implementation will become effective in May 2014, when the recruited internal audit manager takes office.

Following the redefinition of corporate risks as those potentially endangering the implementation of the strategy agreed by Member States, including the top level risks identified in development programmes, the risk management process implemented in the MTG programme was subjected to an external audit which confirmed its soundness. In addition, demographic analyses were started to assess risks related to the ageing of EUMETSAT staff.

Management of development risks focused on those specifically associated with Metop-C and MSG-4, each being the last satellite in a series with very few spare parts left. The most severe risks to materialise were however due to the failure (corrosion and delamination) of generic magnet technology embedded both in the MSG-4 Spinning Enhanced Visible and Infrared Imager (SEVIRI) and in the Metop-C IASI instruments, calling for the assessment of the possible impact on in-orbit assets.

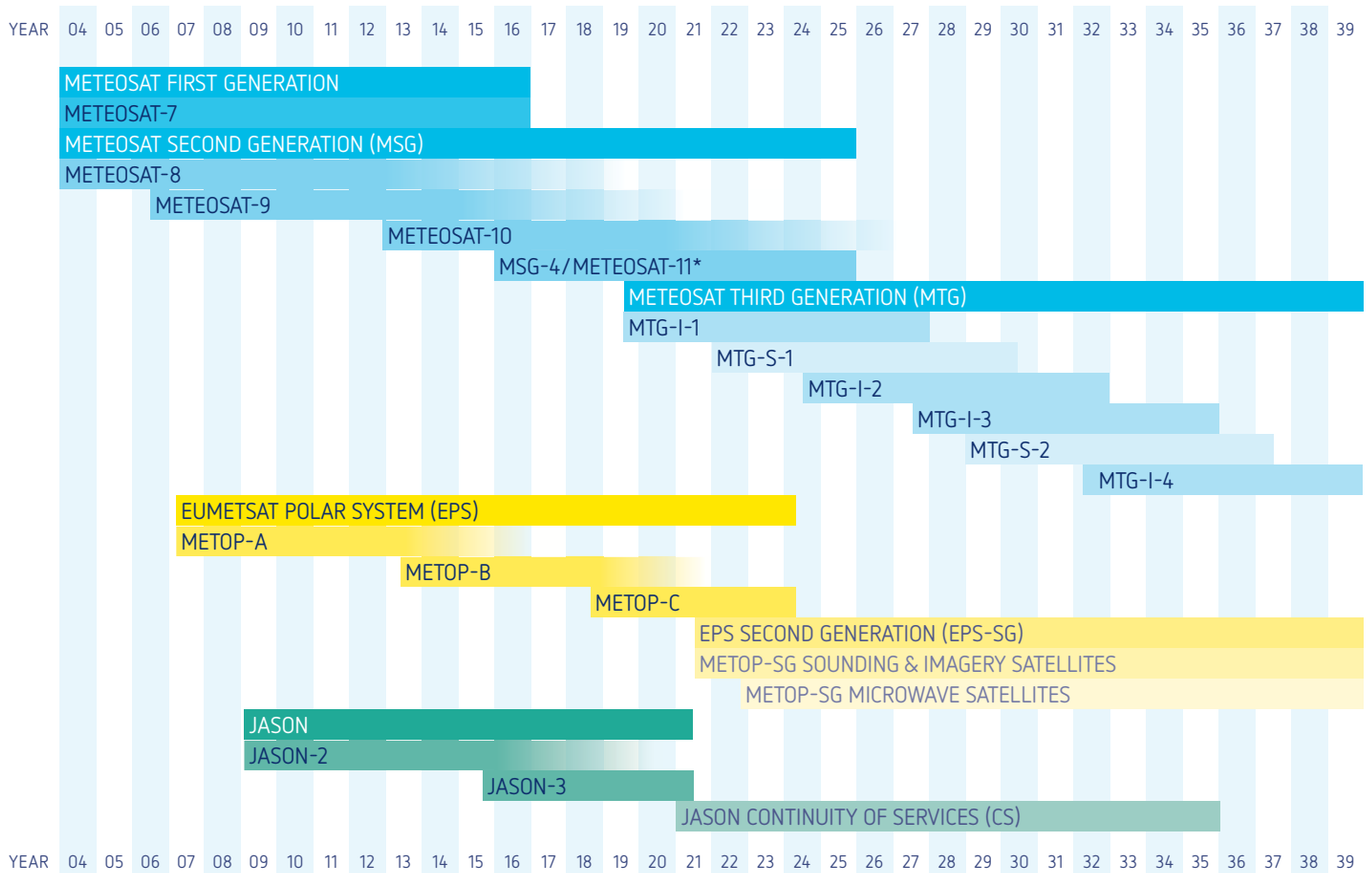
In the area of operations, the anomalies affecting the new Uninterruptable Power Supply (UPS) system in the Technical Infrastructure Building were fixed by the manufacturer and new procedures improved overall maintainability. The system worked perfectly when the electricity supply was interrupted by thunderstorms which hit Darmstadt on 20 June and 22 July.

The Service Continuity Project, aimed at preserving continuity of operations and core services to users, even in case of a disaster at one of EUMETSAT's sites, restarted after the commissioning of Metop-B and Meteosat-10 with the preparation of the deployment of back-up mission support capabilities at the Meteosat Back-up Station and Control Centre (BSCC) in Usingen and at the EPS/Metop Back-up Control Centre (BUCC) in Madrid.

The contribution of this project to the operational resilience of the EUMETSAT ground infrastructure was demonstrated on 22 November, after the collapse of one antenna supporting Meteosat-8 operations in Usingen. The safe control of the satellite could be transferred immediately to back-up facilities available in Usingen and Maspalomas, and the accident had no impact on the services delivered to users. However, an inquiry board chaired by the Director of Operations and Services to Users was set up to determine the root causes of the accident, assess all its contractual, financial and operational consequences and establish a recovery plan with the manufacturer.

KEY FIGURES

EUMETSAT MISSION PLANNING



Only the full operational phase of each mission is represented, excluding commissioning.

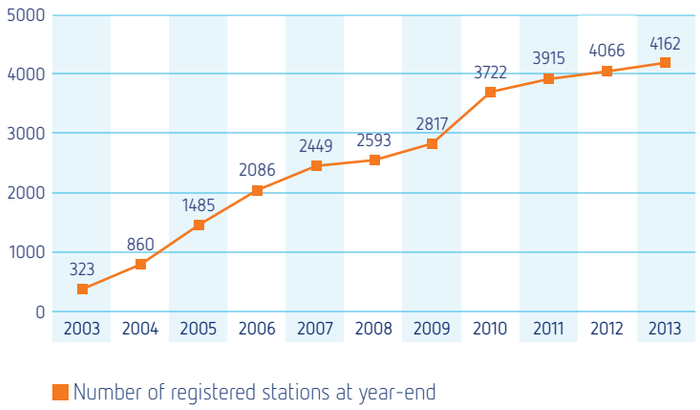
* MSG-4/Meteosat-11 will be stored in orbit, before replacing Meteosat-10

THE EUMETSAT USER BASE

The EUMETSAT user base is comprised of the NMSs of its Member and Cooperating States, ECMWF, international partners and a number of licensed users. At the end of 2013, the number of licensed users was 2,114.

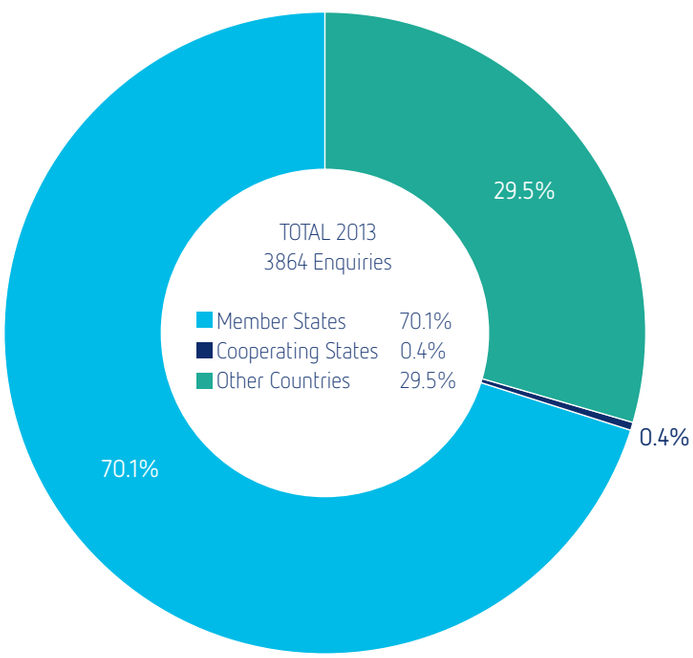
EUMETCAST USERS

At the end of the year there were 4,162 registered EUMETCast reception stations, of which 85% were located in Member and Cooperating States, and 3,275 users.



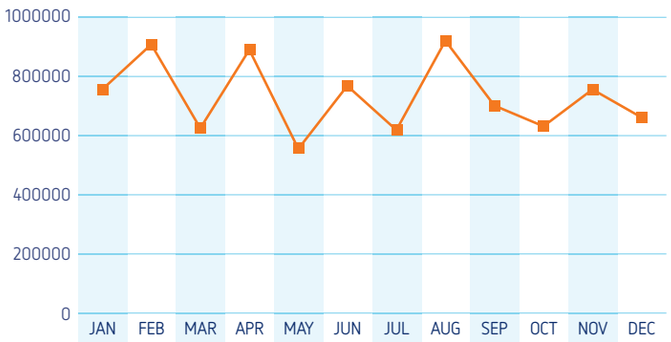
NUMBER OF USER ENQUIRIES

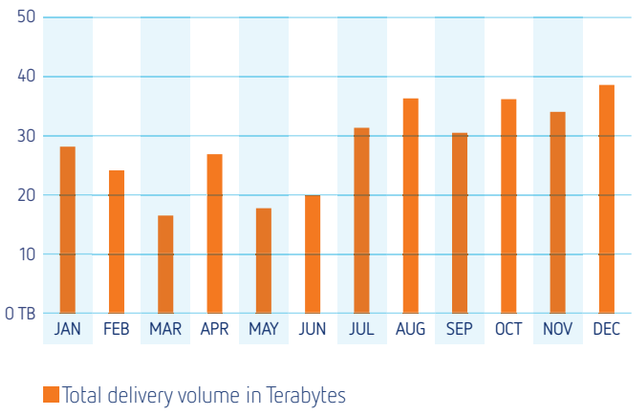
The EUMETSAT User Helpdesk processed a total of 3,864 requests from the user community, 70.5% of which originated from Member and Cooperating States.



DATA CENTRE USERS AND ORDERS

Nearly 2,390 registered users were signed up to acquire archived data at the end of 2013. On average, there are 44 new registrations per month and 200 users a day accessed the Data Centre Online Ordering Tool for search and ordering.





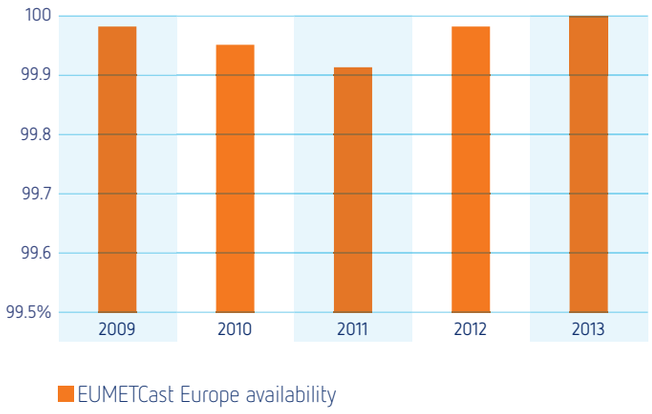
KEY FIGURES

CONTINUED

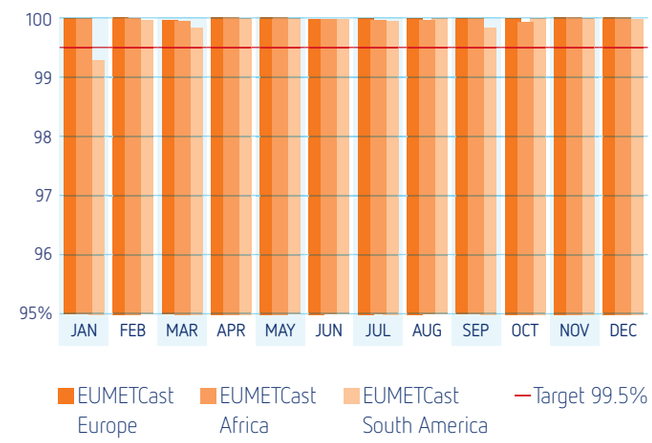
OPERATIONAL PERFORMANCE INDICATORS

EUMETCAST EUROPE AVAILABILITY 2009-2013

The availability of EUMETCast Europe remained at a record-breaking high level throughout the year at 99.99%.

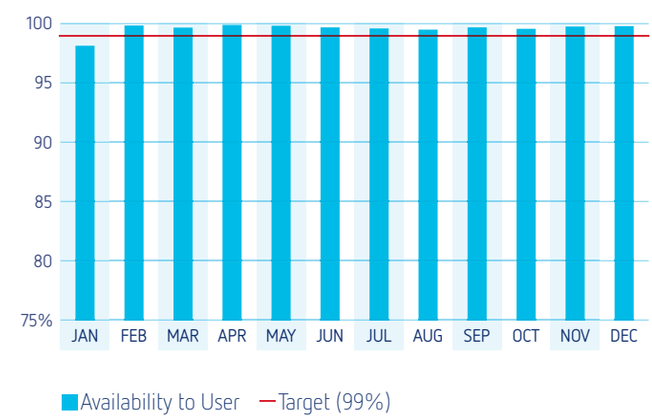


EUMETCAST AVAILABILITY 2013



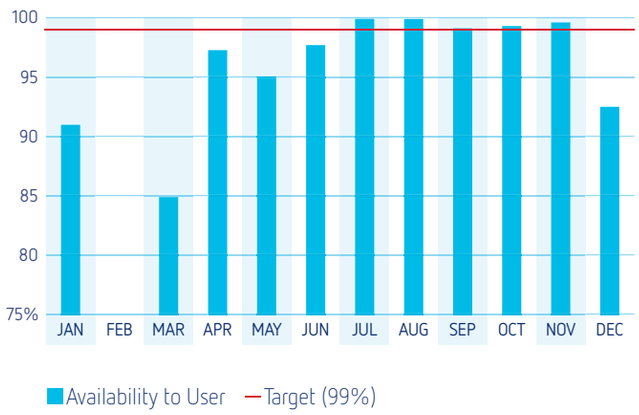
AVAILABILITY OF METEOSAT SEVIRI FULL DISC IMAGE DATA (0°) IN 2013

The availability of the Meteosat Full Earth Scan service at 0° was marginally affected by the manoeuvres of the Meteosat-9 and -10 satellites on 21 January.



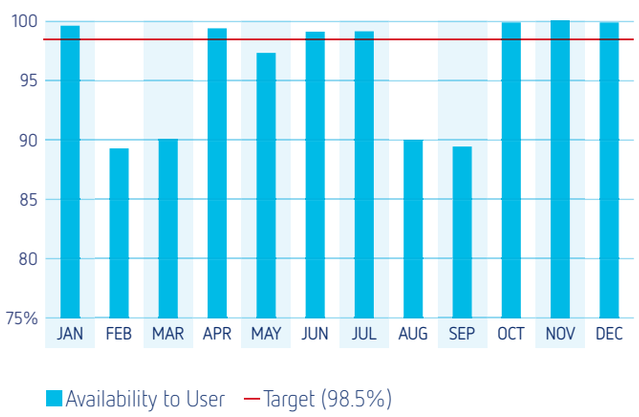
AVAILABILITY OF METEOSAT SEVIRI RAPID SCAN DATA (9.5°E) IN 2013

The RSS service at 9.5° E was paused from 31 January to 5 March, with additional 48-hour monthly pauses in January and May which were eliminated from June when Meteosat-8 started to be used as a back-up satellite. However, the 48-hour monthly gap reappeared in December when Meteosat-8 could no longer be used following the collapse of an antenna. Availability was also affected by unexpected thermal perturbations on board Meteosat-8 during an eclipse in March and when the Meteosat-9 SEVIRI instrument went into safe mode on 1 December.



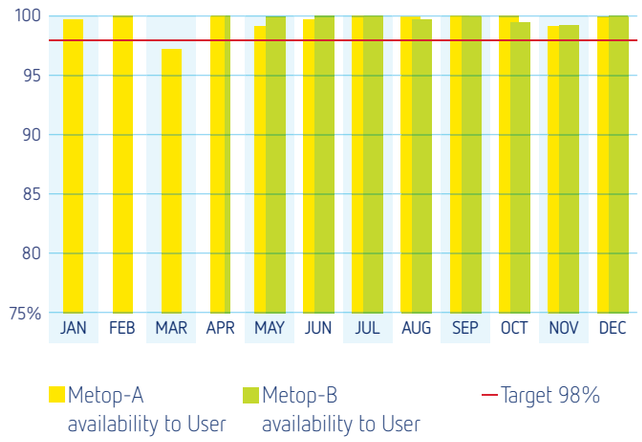
AVAILABILITY OF METEOSAT IODC IMAGE DATA (57.5°E) IN 2013

The IODC service at 57.5° E was only impacted by the spring and autumn eclipse seasons (February-March and August-September) and by some intermittent communication and antenna issues in May.

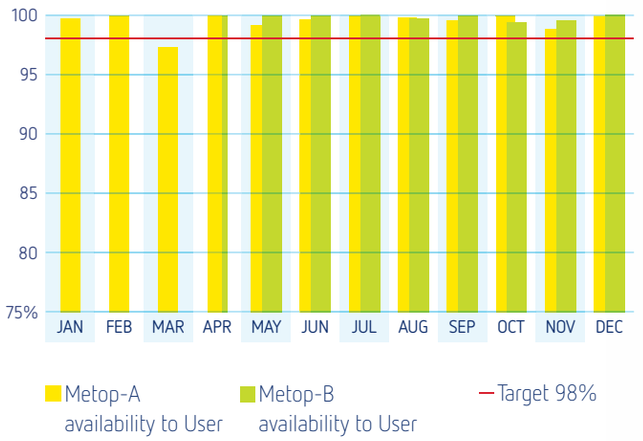


The availability of the Metop global data service was impacted by the Metop-A out-of-plane manoeuvre on 20-21 March, when product processing for most of the instruments had to be deactivated.

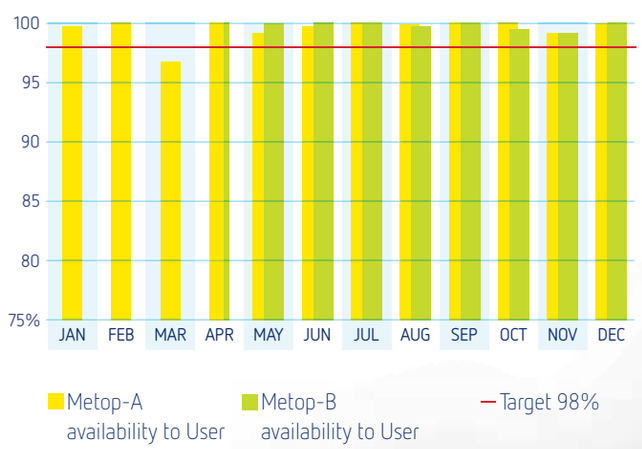
AVAILABILITY OF METOP AMSU LEVEL 1B BUFR DATA IN 2013



AVAILABILITY OF METOP ASCAT LEVEL 1B DATA IN 2013



AVAILABILITY OF METOP MHS LEVEL 1B BUFR DATA IN 2013

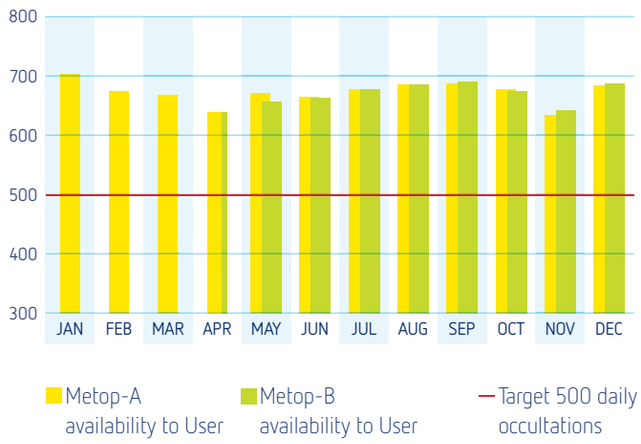


KEY FIGURES

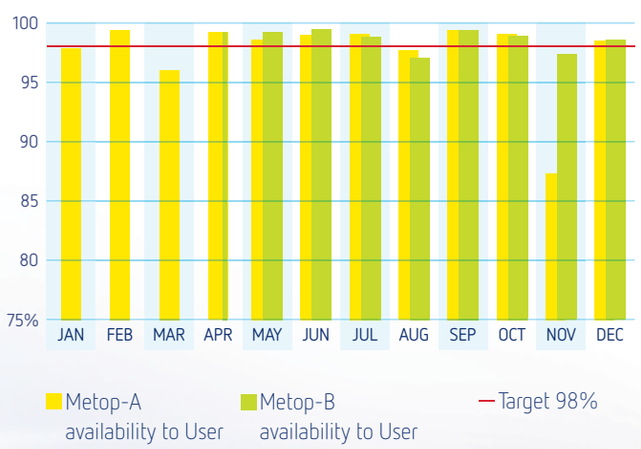
CONTINUED

OPERATIONAL PERFORMANCE INDICATORS

AVAILABILITY OF METOP GRAS LEVEL 1B DATA IN 2013

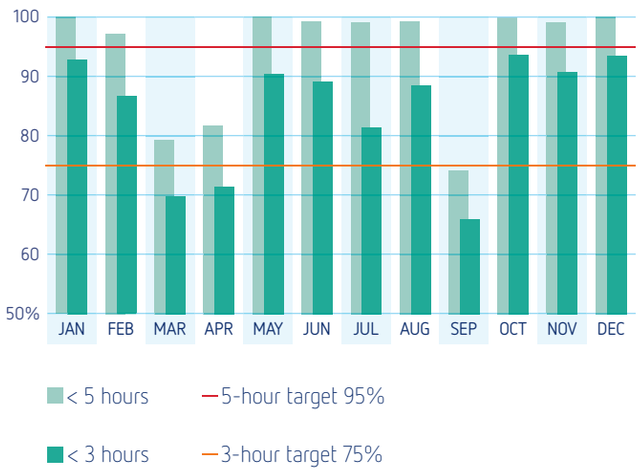


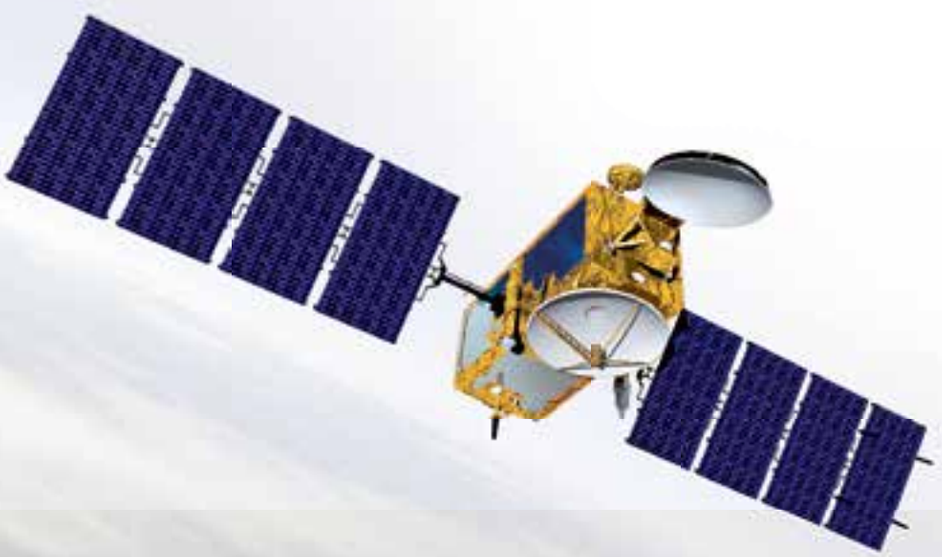
AVAILABILITY OF METOP IASI LEVEL 1C BUFR DATA IN 2013



AVAILABILITY OF JASON-2 OPERATIONAL GEOPHYSICAL DATA RECORDS IN 2013

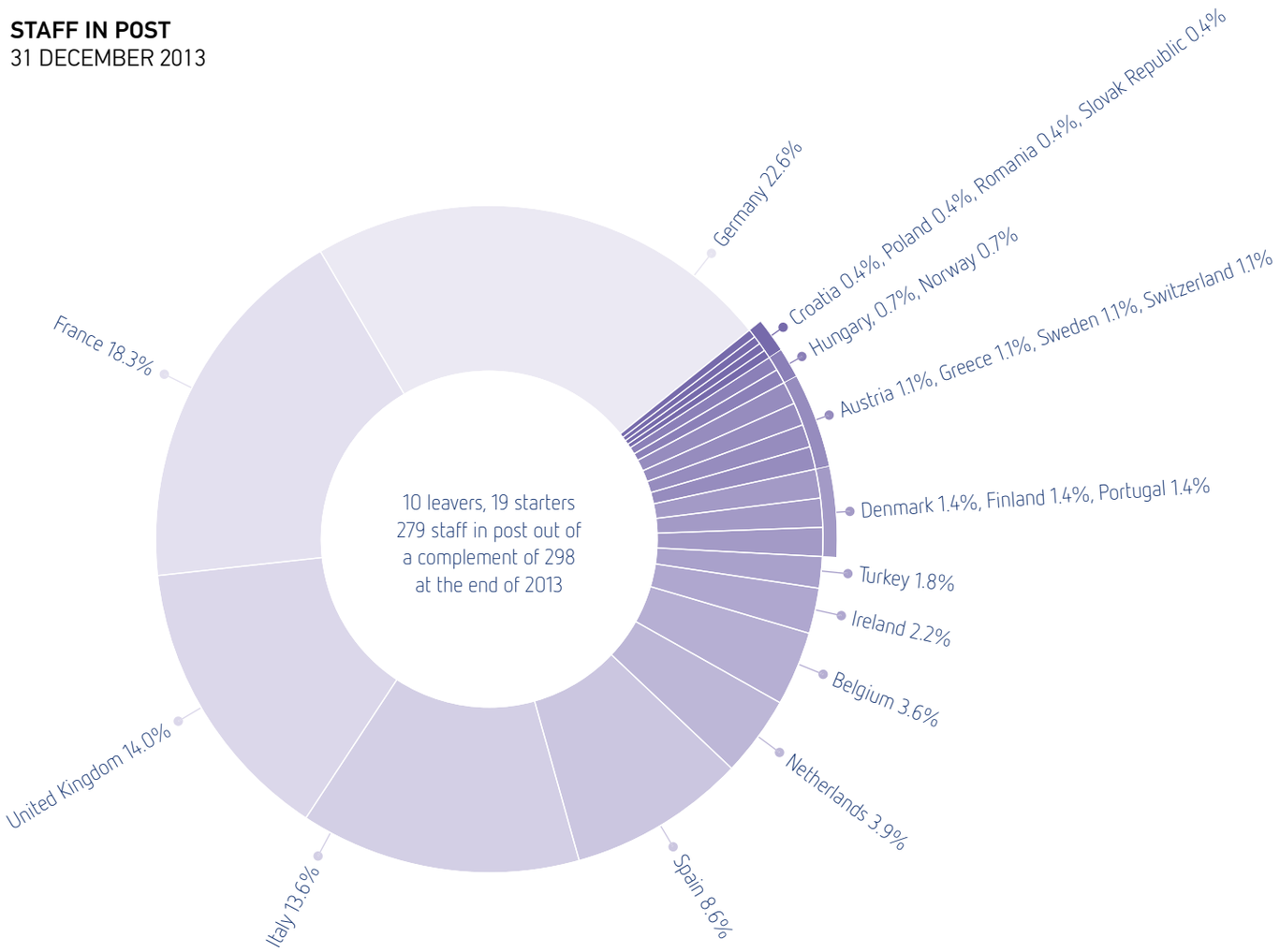
The Jason-2 data service was impacted by the entry into safe mode of the satellite on three occasions, in March, April and September.





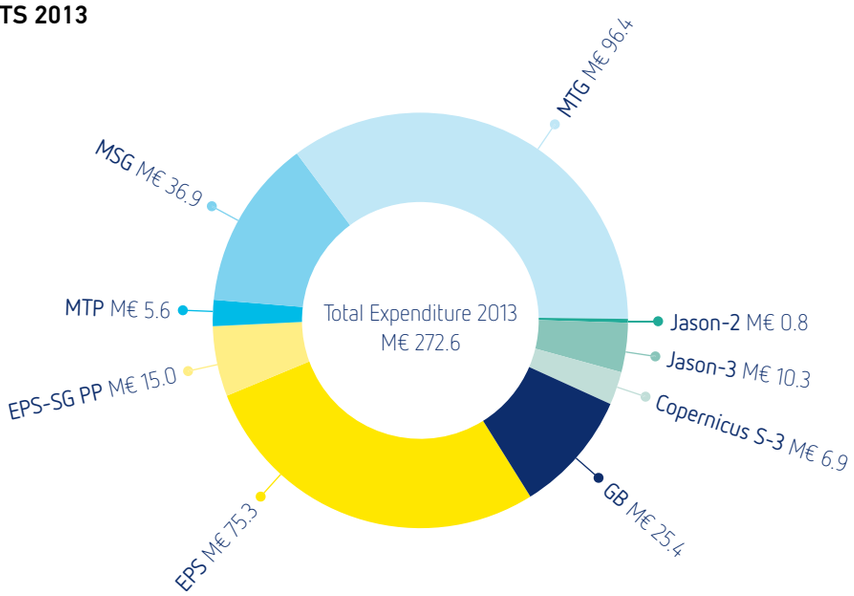
HUMAN RESOURCES

STAFF IN POST
31 DECEMBER 2013



FINANCIAL INFORMATION

EXPENDITURE BUDGETS 2013
M€ 272.6



KEY FIGURES

CONTINUED

FINANCIAL INFORMATION

The 2013 EUMETSAT Financial Statement has been audited by the Bundesrechnungshof. The following tables, in K€, are a summary of the information for 2013 included in those accounts.

SUMMARY REVENUE AND EXPENDITURE 2013

	KEUR
REVENUE	
Member and Cooperating State Contributions	253,492
Other Contributions	-13,892
Tax on Salary	7,822
Sales Revenue	2,001
Other Revenue	41,687
TOTAL REVENUE	291,110
EXPENDITURE	
Costs for Human Resources	103,742
Other Operating Expenses	8,249
Satellites related costs	23,275
SAF, Prospective Activities, Research Fellows	11,059
Depreciation	84,989
Asset Impairments	487
TOTAL EXPENDITURES	231,801
Revenue from Financial Operations	729
NET SURPLUS FOR THE PERIOD	20,633
Surplus to be distributed to Member and Cooperating States	19,687
Result Allocated to Reserves	40,351

SUMMARY BALANCE SHEET 2013

	KEUR
ASSETS	
Current assets	549,924
Non-Current assets	1,670,978
TOTAL ASSETS	2,220,902
LIABILITIES	
Current Liabilities	400,206
Non-Current Liabilities	128,433
TOTAL LIABILITIES	528,639
TOTAL NET ASSETS/EQUITY	1,692,263
TOTAL LIABILITIES & NET ASSETS/EQUITY	2,220,902

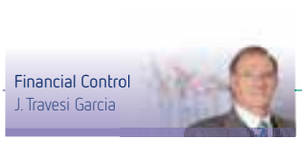
MEMBER AND COOPERATING STATES CONTRIBUTIONS 2013

	KEUR
MEMBER STATE CONTRIBUTIONS	
Austria	5,091
Belgium	6,616
Croatia	845
Czech Republic	2,391
Denmark	4,451
Estonia	568
Finland	3,482
France	37,646
Germany	47,211
Greece	4,279
Hungary	1,750
Ireland	2,914
Italy	29,419
Luxembourg	556
Latvia	393
Netherlands	11,058
Norway	5,455
Poland	5,935
Portugal	3,154
Romania	2,357
Slovenia	669
Slovak Republic	1,106
Spain	19,964
Sweden	6,337
Switzerland	6,492
Turkey	6,755
United Kingdom	35,377
TOTAL MEMBER STATES CONTRIBUTIONS	252,271
COOPERATING STATE CONTRIBUTIONS	
Bulgaria	298
Iceland	130
Lithuania	537
Serbia	256
TOTAL COOPERATING STATE CONTRIBUTIONS	1,221
TOTAL MEMBER AND COOPERATING STATES CONTRIBUTIONS	253,492

APPENDIX

ORGANISATION, 1 JANUARY 2014

Director-General
Alain Ratier



Financial Control
J. Travesi Garcia

Prof P. Taalas (Chairperson)
Finnish Meteorological Institute
Prof A. Eliassen (Vice-Chairperson)
Norwegian Meteorological Institute
EUMETSAT Council

Chief Scientist
Dr J. Schmetz

Communication and Information Services
C. Ritsert-Clark

Quality Management and Assessment
G. Bernède

Strategy and International Relations
P. Counet

Mr I. Čačić (Chairperson)
Dr M. Gray (Vice-Chairperson)
Policy Advisroy Committee (PAC)

Mr B. Truscott (Chairperson)
Mr S. Nilsson (Vice-Chairperson)
Scientific and Technical Group (STG)

Mr P. Labrot (Chairperson)
Mr A. Dybbroe (Vice-Chairperson)
STG Operations Working Group (STG-OWG)

Mr H. Roquet (Chairperson)
Ms I. Trigo (Vice-Chairperson)
STG Science Working Group (STG-SWG)

Mr M. Palomares (Chairperson)
Dr G. Seuffert (Vice-Chairperson)
Administrative and Finance Group (AFG)

Mr A. Rubli (Chairperson)
Mr P. Santoni (Vice-Chairperson)
Data Policy Group (DPG)

Dr G. Kortchev (Chairperson)
Mr M. Dadic (Vice-Chairperson)
EUMETSAT Advisory Committee of Cooperating States (EACCS)

Director of Programme Preparation and Development
Ernst Koenemann

Director of Operations and Services to Users
Livio Mastroddi

Director of Administration
Silvia Castañer

Director of Technical and Scientific Support
Yves Buhler

Geostationary Programmes
S. Rota

Flight Operations
M. Williams

Contracts
E. Katsampani

Process Assurance and Management Support
L. Sarlo

Low Earth Programmes
Dr M. Cohen

Real Time Services and System Operations
S. Burns

Finance
P. Collin

Generic Systems and Infrastructure
G. Mori

User Support and Climate Services
Dr V. Gärtner

General Services
B. Kaufmann

Remote Sensing and Products
K. Holmlund

Personnel
F. Brazil

System Engineering and Projects
J. González Picazo

Legal Affairs
M. Lauth (acting)

APPENDIX

CONTINUED

EUMETSAT COUNCIL DELEGATES AND ADVISORS

AUSTRIA

Dr M. Staudinger	Zentralanstalt für Meteorologie und Geodynamik (ZAMG)
Mr L.A. Berset	Österreichische Forschungsförderungs-gesellschaft

BELGIUM

Dr D. Gellens	Insitut Royal Météorologique (IRM)
Mr P. Rottiers	Belgian Science Policy Office

BULGARIA

Mr G. Kortchev	National Institute of Meteorology and Hydrology

CROATIA

Mr I. Čačić	Meteorological and Hydrological Service (DHMZ)
Dr B. Lipovščak	DHMZ

CZECH REPUBLIC

Mr V. Dvorak	Czech Hydrometeoro-logical Institute (CHMI)
Ms P. Skrivankova	CHMI

DENMARK

Ms M Thyrring	Danish Meteorological Institute (DMI)
Dr L. Prahm	DMI
Prof P. Thorsen	DMI

ESTONIA

Mr J. Mandel	Estonian Environment Agency

FINLAND

Dr Y. Viisanen	Finish Meteorological Institute
Mr P. Plathan	Ministry of Transport and Communication

FRANCE

Mr F. Jacq	Météo-France
Mr O. Gupta	Météo-France
Ms I. Bénézeth	Ministère de l'Ecologie, du Développement durable et de l'Energie
Ms C. Carretta	Centre National d'Etudes Spatiales (CNES)

GERMANY

Prof Dr G. Adrian	Deutscher Wetterdienst
Mr H.J. Koppert	Deutscher Wetterdienst
Mr J. Saalmüller	Deutscher Wetterdienst
Dr G. Seuffert	Bundesministerium für Verkehr-, Bau- und Stadtentwicklung
Dr C. Brüns	Deutsches Zentrum für Luft- und Raumfahrt

GREECE

Brig Gen D. Konidaris	Hellenic National Meteorological Service
Lt Col A. Fiamegkos	Hellenic National Meteorological Service

HUNGARY

Ms K. Radics	Hungarian Meteorological Service (OMSZ)

ICELAND

Mr A. Snorrason	Icelandic Meteorological Office

IRELAND

Mr L. Campbell	Met Éireann

ITALY

Lt Col. L. De Leonibus	Ufficio Generale per la Meteorologia
Mr L. Musmanno	Ufficio Generale per la Meteorologia
Mr S. Bruzzi	Agenzia Spaziale Italiana

OBSERVERS

EACCS Chairperson (Bulgaria)
ECMWF
ESA
EUMETNET
European Commission
NOAA
WMO

LATVIA

Ms I. Stikute	Latvian Environment, Geology and Meteorology Centre

LITHUANIA

Ms V. Auguliene	Lithuanian Hydrometerological Service

LUXEMBOURG

Ms M. Reckwerth	Administration de la navigation aérienne

NETHERLANDS

Dr F. Brouwer	Koninklijk Nederlands Meteorologisch Instituut

NORWAY

Prof A. Eliassen	Norwegian Meteorological Institute (Met.no)
Mr J. Sunde	Met.no
Mr P. Skrovsek	Norwegian Space Centre

POLAND

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PARTICIPATION IN MAJOR EXTERNAL EVENTS

6-9 January	American Meteorological Society (AMS) Annual Conference	Austin, Texas, USA
29-30 January	European Conference on European Space Policy	Brussels, Belgium
4-5 March	EUMETSAT hosted the second meeting of the World Climate Research Programme (WCRP) Data Advisory Council	Darmstadt, Germany
13-14 March	Meeting of the Strategy Implementation Team of CEOS, Langley Space Centre	Hampton, Virginia, USA
8-11 April	National Oceanic and Atmospheric Administration (NOAA) Satellite Conference	Washington, USA
6-8 May	International Ocean Colour Science Meeting	Darmstadt, Germany
17-18 May	World Meteorological Organization (WMO) Executive Council meeting	Geneva, Switzerland
11-13 June	SpaceOps Workshop – Countering Security Threats to Space Flight and Ground Systems	Washington, USA
18-19 June	European Ground System Architecture Workshop	Darmstadt, Germany
1 July	First meeting of the Intergovernmental Board for Climate Services (IBCS-1), workshop "Operational Climate Services: a dialogue on practical action"	WMO, Geneva
8-12 July	Coordination Group for Meteorological Satellites (CGMS) 41st Plenary	Tsukuba, Japan
26-30 August	International CALMET Conference	Toulouse, France
5 September	European satellite day, global risks and satellite answers, foresight in European space capabilities for enhanced global stability	Brussels, Belgium
8-10 October	Ocean Surface Topography Science Team (OSTST) and 7th Coastal Altimetry Workshop	Boulder, USA
14-15 October	15th European Inter-parliamentary Space Conference (EISC)	Brussels, Belgium
15-17 October	Meteorological Technology World Expo	Brussels, Belgium
29-30 October	Global Monitoring for Environment and Security (GMES)-PURE Marine User Requirements Consolidation Workshop	Brussels, Belgium
5-6 November	Committee on Earth Observation Satellites (CEOS) Plenary	Montreal, Canada
13-14 November	Space Situational Awareness (SSA) 2013	London, UK
17-24 November	Disasters Charter Secretariat and Board Meeting	Cordoba, Argentina

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APPENDIX

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GLOSSARY OF TERMS AND ACRONYMS

3MI	Multi-viewing, -channel, -polarisation Imaging (EPS-SG)
ACP	African, Caribbean and Pacific Group of States
ADCS	Advanced Data Collection System
AEMET	Agencia Estatal de Meteorología
AMESD	African Monitoring of the Environment for Sustainable Development
AMS	American Meteorological Society
AMSU	Advance Microwave Sounding Unit (Metop)
AMV	Atmospheric Motion Vectors
ASCAT	Advanced Scatterometer (Metop)
ASECNA	Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar
ATMS	Advanced Technology Microwave Sounder (Suomi NPP)
ATOVS	Advanced TIROS Operational Vertical Sounder (Metop)
AUC	African Union Commission
AVHRR	Advanced Very High Resolution Radiometer (Metop)
BoM	Australian Weather Bureau
CCI	Climate Change Initiative (ESA)
CDR	Climate Data Record
CEOS	Committee on Earth Observation Satellites
CGMS	Coordination Group for Meteorological Satellites
CLAAS	CLoud property dAtAset using SEVIRI
CLS	Collecte Localisation Satellites
CMA	China Meteorological Administration
CM SAF	SAF on Climate Monitoring
CNES	Centre National d'Etudes Spatiales (French space agency)
Copernicus	European Earth Observation Programme
CORE-CLIMAX	Coordination of Earth Observation Data Validation for Reanalysis (EC/FP7)
CrIS	Cross-track Infrared Sounder (Suomi NPP)
CSA	Canadian Space Agency
CSDP	Climate Services Development Plan
CSPP	Community Satellite Processing Package (University of Wisconsin-Madison)
DLR	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center)
DQS	Deutsche Gesellschaft zur Zertifizierung von Managementsystemen
DWD	Deutscher Wetterdienst
EARS	EUMETSAT Advanced Retransmission Service
EC	European Commission
ECMWF	European Centre for Medium-Range Weather Forecasts
ECV	Essential Climate Variable
EDF	European Development Fund
EISC	European Inter-parliamentary Space Conference
EPS	EUMETSAT Polar System
EPS-SG	EPS Second Generation
ERA-CLIM	European Reanalysis of Global Climate Observations

ERP	Enterprise Resource Planning
ESA	European Space Agency
ESOC	European Space Operations Centre (ESA)
ESPI	European Space Policy Institute
EU	European Union
EUMETCast	EUMETSAT's satellite data broadcast system
FCI	Flexible Combined Imager
FES	Full Earth Scan
FP7	European Framework Programme 7
FWD2020	Forward 2020: the EUMETSAT reorganisation project
FY	Fengyun (Chinese meteorological satellites)
GCOS	Global Climate Observing System
GEO	Group on Earth Observations
GEONETCast	Global network of satellite data broadcast systems
GERB	Geostationary Earth Radiation Budget (MSG)
GFCS	Global Framework for Climate Services (WMO)
GIO	GMES Initial Operations programme
GNSS	Global Navigation Satellite System
GOME-2	Global Ozone Monitoring Experiment-2 (Metop)
GPM	Global Precipitation Measurement Mission
GRAS	GNSS Receiver for Atmospheric Sounding (Metop)
GSICS	Global Space-based Inter-Calibration System (CGMS/WMO)
H SAF	SAF on Support to Operational Hydrology and Water Management
HIRS	High-resolution Infrared Radiation Sounder (Metop)
HPOA	High Precision Ocean Altimetry
HY	Haiyang (Chinese oceanographic satellites)
IASI	Infrared Atmospheric Sounding Interferometer (Metop)
IASI-NG	IASI Next Generation (EPS-SG)
IBCS	Intergovernmental Board for Climate Services
ICI	Ice Cloud Imager (EPS-SG)
IJPS	Initial Joint Polar System
IODC	Indian Ocean Data Coverage
IPCC	International Panel on Climate Change
IPSL	Institut Pierre Simon Laplace
ISRO	Indian Space Research Organisation
Jason-2	HPOA satellite (NASA/CNES/NOAA/EUMETSAT)
Jason-3	HPOA satellite (NASA/CNES/NOAA/EUMETSAT/EC)
Jason-CS	Jason Continuity of Service
JAXA	Japan Aerospace Exploration Agency
JPS	Joint Polar System
JSpOC	Joint Space Operation Centre (US Air Force)
KMA	Korea Meteorological Agency
KNMI	Royal Netherlands Meteorological Institute
LSA SAF	SAF on Land Surface Analysis
MESA	Monitoring of Environment and Security in Africa
Meteosat	EUMETSAT geostationary meteorological satellite
Metop	Meteorological Operational satellite (EPS)
MHS	Microwave Humidity Sounder (Metop)
MMDS	EUMETSAT multi-mission real-time data dissemination system
MOF	Mission Operations Facility
MSG	Meteosat Second Generation
MTG	Meteosat Third Generation
MTG-I	MTG Imaging satellite
MTG-S	MTG Sounding satellite
MWI	Microwave Imaging for precipitation (EPS-SG)
MWS	Microwave Sounding (EPS-SG)
NASA	National Aeronautics and Space Administration (US)
NMHS	National Meteorological and Hydrological Service
NMS	National Meteorological Service
NOAA	National Oceanic and Atmospheric Administration (US)
NWC SAF	SAF on Nowcasting and Very Short Range Forecasting
NWP	Numerical Weather Prediction
NWP SAF	SAF on Numerical Weather Prediction
O3M SAF	SAF on Ozone and Atmospheric Chemistry Monitoring
Oceansat	Indian ocean remote sensing satellite (ISRO)
OSI SAF	SAF on Ocean and Sea Ice
OSTM	Ocean Surface Topography Mission (implemented by Jason-2/-3)
OSTST	Ocean Surface Topography Science Team
PDR	Preliminary Design Review
PURE	Partnership for User Requirements Evaluation (Copernicus)
RAL	Rutherford Appleton Laboratory
RO	Radio Occultation (EPS-SG)
ROM SAF	SAF on Radio Occultation Meteorology
RSS	Rapid Scan Service
SADCA	Satellite Data for Central Asia
SAF	Satellite Application Facility
SCOPE-CM	Sustained, Coordinated Processing of Environmental Satellite Data for Climate Monitoring (WMO)
Sentinel-3	Copernicus ocean monitoring satellite
SEVIRI	Spinning Enhanced Visible and Infrared Imager (MSG)
SNI	Storage Network Infrastructure
Suomi NPP	Suomi National Polar-orbiting Partnership (NASA/NOAA)
TIB	Technical Infrastructure Building
TIROS	Television Infrared Observation Satellite
TTCF	Telemetry, Tracking and Commanding Facility
UPS	Uninterruptable Power Supply
UTC	Coordinated Universal Time
VII	Visible-Infrared Imaging
Vlab	Virtual Laboratory for Training and Education in Satellite Meteorology (WMO)
WMO	World Meteorological Organization

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Big Bang illustration, Particle Data Group, LBNL, © 2013

BELGIUM

Georges Lemaître
17 July 1894 - 20 June 1966

Lemaître, a Roman Catholic priest, physicist and mathematician, was the first person to propose what is now known as the Big Bang Theory of the origin of the universe, described as, "the most beautiful and satisfactory explanation of creation to which I have ever listened", by Albert Einstein. Lemaître also researched cosmic rays and derived "Hubble's Law".

CROATIA

Leopold Ružička
13 September 1887 - 26 September 1976

Born in Vukovar, where his birthplace has become a memorial museum, Ružička won the Nobel Prize for Chemistry in 1939. He became a Swiss citizen but retained strong links to his homeland, establishing the Swiss-Yugoslav Relief Society during World War II and assisting Croatian chemists.

AUSTRIA

Julius von Hann
23 March 1839 - 1 October 1921

Regarded as the father of modern meteorology, Hann recognised the importance of three-dimensional observation systems. He helped initiate quantitative methods in climatology and wrote more than 1,000 publications on meteorology and climatology. Professor of Meteorology at the universities of Vienna and Graz, he was an editor of the respected "Meteorologische Zeitschrift" for more than 50 years.

DENMARK

Niels Henrik David Bohr
7 October 1885 - 18 November 1962

Bohr won the Nobel Prize for Physics in 1922 for his contributions to the understanding of the structure of atoms and quantum theory. He also conceived the principle of complementarity, which strongly influenced his thinking in philosophy and science. Involved in the Atomic Energy Project in World War II, he later advocated openness and cooperation between nations on atomic energy.

PORTUGAL

Ferdinand Magellan
c. 1480 - 27 April 1521

Explorer who led the expedition which completed the first circumnavigation of the globe. Although Magellan died during the journey, he made a crucial contribution to geography. His was the first European expedition to cross the Pacific Ocean, which he named, and he discovered the Strait of Magellan at the southern point of South America.

CZECH REPUBLIC

Gregor Mendel
20 July 1822 - 6 January 1884

Although most of Mendel's published works relate to meteorology, he is most famous for his discoveries in the field of genetics. Mendel, through his work with pea plants, discovered the fundamental laws of inheritance.

POLAND

Nicolaus Copernicus
19 February 1473 - 24 May 1543

Renaissance mathematician and astronomer best known for formulating a heliocentric model of the universe, which held that the Earth rotates daily on its axis and revolves yearly around the sun. Copernicus was the first person to propose a fact-based model of the universe by combining physics, astronomy and mathematics.

SWEDEN

Vagn Walfrid Ekman
3 May 1874 - 9 March 1954

Oceanographer whose research contributed significantly to understanding the dynamics of ocean currents. The term "Ekman Spiral" derives from his research explaining why icebergs do not drift in the same direction as the prevailing wind. He invented scientific instruments, including a current meter and a water sampling instrument, which are still used today.

ESTONIA

Jaan Einasto
Born 23 February 1929

Estonian astrophysicist and cosmologist Einasto has made ground-breaking contributions to the discovery of dark matter and the large-scale structure of the universe and received a number of prestigious awards. The asteroid 11577 Einasto was named after him.

HUNGARY

Theodore von Kármán
11 May 1881 - 6 May 1963

An aerospace engineer, physicist and teacher who made outstanding contributions in his field, von Kármán was responsible for many advances in aerodynamics, particularly in relation to supersonic and hypersonic airflow characterisation. He became a US citizen and received that country's first National Science Medal from President Kennedy in 1963.

IRELAND

George Johnstone Stoney
15 February 1826 - 5 July 1911

A physicist who contributed significantly to the study of cosmic physics and the theory of gases, Stoney conceived and calculated the magnitude of the atom or particle of electricity, and is most famous for coining the term "electron" to describe this fundamental unit quantity of electricity.

SWITZERLAND

Horace-Bénédict de Saussure
17 February 1740 - 22 January 1799

Physicist, geologist and alpine explorer whose contributions to science are wide-ranging. Among de Saussure's inventions are the hygrometer, to measure atmospheric humidity, probably the first electrometer, to measure electric potential and a solar collector, or solar oven, an insulated box which reached 230° F. He was among the first to establish the atmospheric lapse rate.

ICELAND

Sigurður Þórarinsson
8 January 1912 - 8 February 1983

Thorarinsson (Þórarinsson) was a geologist, volcanologist, glaciologist, professor and lyricist. He gained international renown for his contributions to glaciology, geomorphology and volcanology and is credited with pioneering tephrochronology, a method determining age by examining layers of volcanic ash.

ITALY

Galileo Galilei
15 February 1564 - 8 January 1642

From discovering the law of the pendulum, developing a forerunner to the thermometer and creating a more effective telescope and using it to discover the moon's craters and Jupiter's four largest moons, Galileo made many original contributions to science and the development of the scientific method.

FINLAND

Erik Palmén
31 August 1898 - 19 March 1985

Meteorologist and oceanographer Palmén is considered as the discoverer of the polar and subtropical jet streams, contributing to the explanation of their dynamics. Palmén also studied cyclones, hurricanes and typhoons and showed why tropical hurricanes form only in certain regions at certain times. He received the Buys-Ballot Medaille award of the Royal Dutch Academy in 1964.

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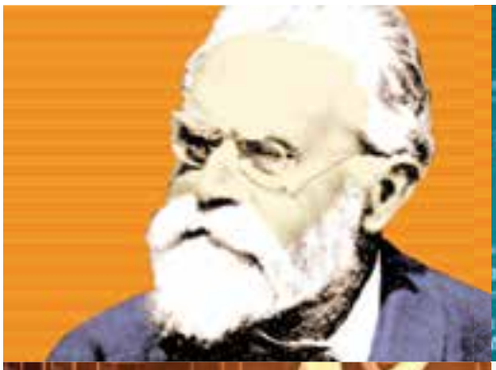


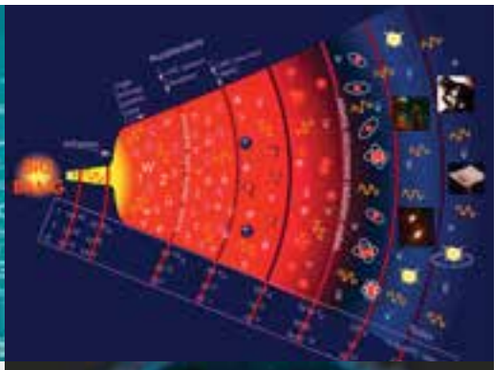

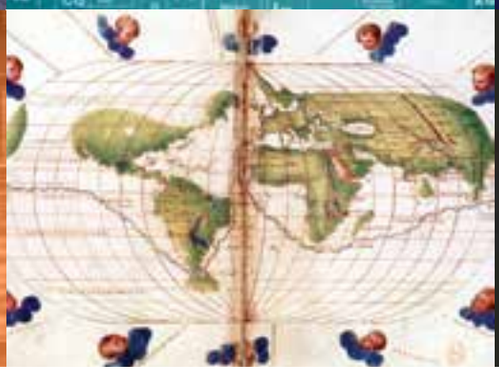


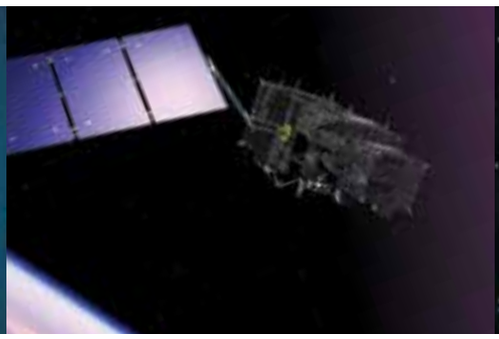

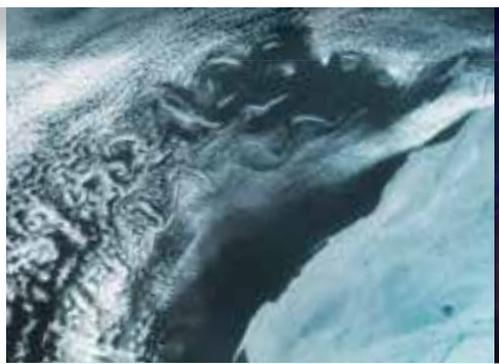

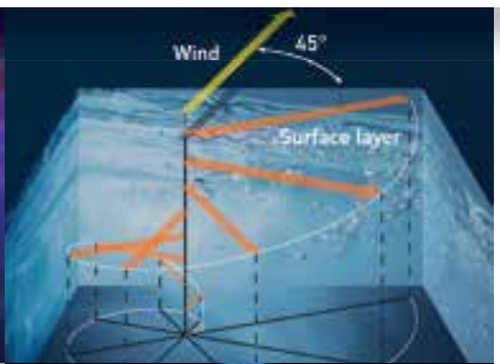

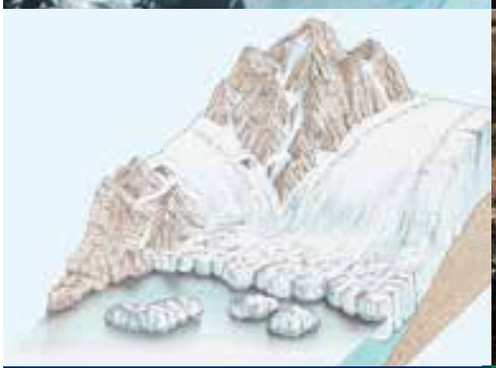


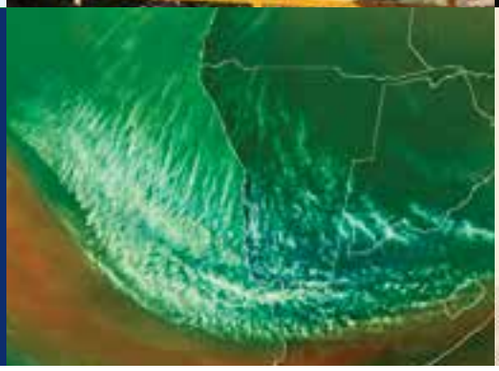
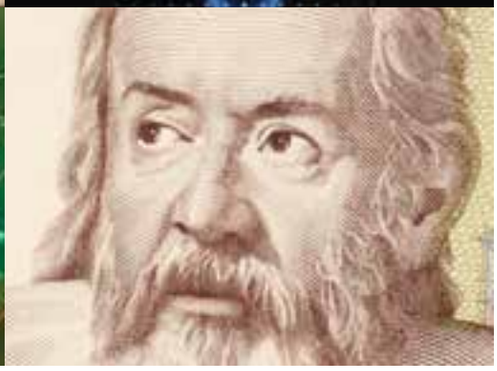

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