ANNUAL REPORT 2014

EUMETSAT

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THE WORD OF THE DIRECTOR-GENERAL

Alain Ratier
Director-General

In 2014, the smooth operations of our seven satellites once again resulted in the very high availability of all data services delivered to users, but this required careful management of the risks inherent in the exploitation of complex satellite systems. For instance, a new procedure had to be designed to safely restart the MHS microwave sounder on Metop-A, after it had stopped working during the last out of plane manoeuvre of this ageing satellite.

The portfolio of data services was further enriched for the benefit of users, in particular by the introduction of innovative multi-sensor and multi-satellite products and new third party data services involving our partners from the US, China, India and Japan.

One major achievement was the enhancement of the scope and latency of the data services from the Initial Joint Polar System (IJPS) shared with NOAA. The EARS regional data service became a true IJPS service delivering sounding and imagery products from both the mid-morning and afternoon orbits within 15-30 minutes of sensing. Now we look forward to expanding that service to include data from the FY-3 satellite series, in cooperation with the China Meteorological Administration.

For all EUMETSAT staff, the reward is the satisfaction of having contributed throughout the year to forecasts of high impact weather which saved lives and brought value to the economy. One regret, however, is that Meteosat image loops are not yet available in the cockpits of airliners to assist pilots confronted with convective cloud systems that may have been one factor in the crash of Air Algérie flight 5017 in Mali.

Another ground for satisfaction was the completion of a cycle of innovative evolutions of ground systems rewarded by improved cost efficiency and resilience of operations: the annual cost of the EUMETCast data broadcasting service was cut by 50%, combined with a doubling of bandwidth capacity, and the virtualisation of the Meteosat data processing chain reduced power consumption by a factor of six and CO_2 emissions accordingly.

But above all, 2014 was exceptionally demanding because of the combination of the preparation of the launches of MSG-4, Jason-3 and Sentinel-3A, all planned in 2015, the continuation of the challenging Meteosat Third Generation (MTG) development, and the preparation of three new programmes that will shape EUMETSAT's future and create new opportunities for its Member States, Europe and the worldwide user communities.

Both MSG-4 and Jason-3 are on track for launch in July 2015, after two successful cooperative test campaigns, and testing of the Sentinel-3 ground segment with ESA passed major milestones.

Preparing for the more distant future, the MTG programme entered its detailed design phase with most of the major contracts placed and others subject to ongoing procurement actions, including the launch services for the first three satellites.

From a strategic perspective, the most important challenge was the preparations for the approval of three new programmes by Member States: the EPS Second Generation (EPS-SG) mandatory programme, the Jason-CS optional programme and the EU-funded third party programme covering EUMETSAT's contribution to the EU Copernicus programme.

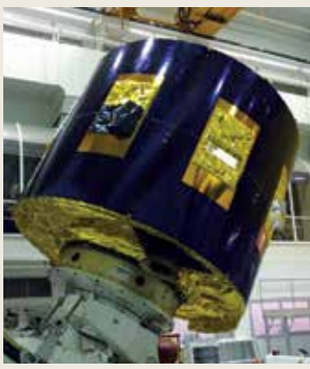
After costs were reduced by 4.7% through descoping of requirements, optimisation and reuse of existing assets on the ground, the approval process of the EPS-SG Programme started in September and, by the end of the year, 87.55% of the funding required was covered by commitments by 24 Member States. The programme includes three successive pairs of Metop-SG satellites equipped with different instrument payloads to cover 21 years of operations at an annualised cost lower than EPS, starting in 2021.

In parallel, the successful conclusion of demanding negotiations with the European Commission established the role of EUMETSAT in the Copernicus programme. The agreement with the European Union was signed on 7 November, three weeks after the approval of the third party programme providing the EUMETSAT legal framework for its implementation. EUMETSAT will thus exploit the Sentinel-3, -4, -5 and -6 marine and atmospheric missions on behalf of the EU in cooperation with ESA. EUMETSAT's ambition is to deliver an integrated stream of Copernicus, EUMETSAT and third party mission data and offer equal opportunities to users in the EU and EUMETSAT Member States.

The optional Jason-CS programme was opened for subscription on 26 November, as EUMETSAT's proposed contribution to the development and implementation of the Sentinel-6 cooperative mission involving the EU, ESA, NASA and NOAA. The mission will continue the high precision sea level measurements of Jason-3 in the 2020-2030 timeframe.

The international agenda was dominated by our annual chairmanship of the Committee on Earth Observation Satellites, the organisation of the Symposium on "Climate Research and Earth Observation from Space: Climate Information for Decision Making" with the World Climate Research Programme, and a very productive 11th User Forum in Africa opening new perspectives for capacity building.

All these achievements required the highest commitment from everyone working at EUMETSAT 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 trust and guidance.



2014 HIGHLIGHTS

2014 was marked by the completion of major ground system upgrades for more efficient operations, preparations for the launches of the MSG-4, Jason-3 and Sentinel-3A satellites, all planned in 2015, the start of the approval process of the EPS-SG programme, and the beginning of EUMETSAT's contribution to the EU Copernicus programme.

The IJPS Antarctic Data Acquisition service enhancing the latency of Metop-B products becomes operational

Start of the construction of the New Office Building

Lithuania and Iceland become the 28th and 29th Member States

The new cooperation agreement with the Indian Space Research Organisation enters into force

The preliminary design phase (phase B) for the Meteosat Third Generation system is formally closed

The System Requirements Review (Part 1) validates the requirements for the development of the Sentinel-6/Jason-CS system

The accelerated upgrade of one antenna restores the capacity to exploit three Meteosat Second Generation satellites simultaneously

Bulgaria becomes the 30th Member State

Release of the invitation to tender for the Sentinel-3 operations support team, on behalf of the European Union

Cornerstone laying ceremony for the New Office Building

The System Requirements Review validates the requirements for the development of the EPS Second Generation system

Release of the invitation to tender for the product extraction facility of the Meteosat Third Generation ground segment

The Suomi NPP satellite becomes the operational NOAA satellite within the Initial Joint Polar System shared with the US

Signature of the agreement on further data exchange and cooperation opportunities with the China Meteorological Administration

Release of the request for quotation to Arianespace for the launch services for the first three Meteosat Third Generation satellites

Release of invitation to tender for the Launch and Early Operations Phase (LEOP) services for the first three Meteosat Third Generation satellites

Successful completion of the Optical Vacuum Test of the MSG-4 satellite

Successful completion of the Thermal Vacuum Test of the Jason-3 satellite

The Council finalises the proposal for the EPS Second Generation programme and the legal instruments for its approval

Start of the new EUMETCast Europe data broadcasting service implementing the DVB-S2 standard

Signature of the extension of the Cooperating State Agreement with Serbia

Annual EUMETSAT User Conference, co-organised with MeteoSwiss in Geneva

Opening of the approval process for the EPS Second Generation programme

Entry into force of the extension of the Jason-2 programme until end of 2017

Kick-off of the development contract for the Meteosat Third Generation mission data acquisition ground stations

ESA and industry sign the Metop Second Generation satellite contracts funded 58% by EUMETSAT

Entry into force of the third party programme on EUMETSAT activities in support of Copernicus

Climate Symposium co-organised in Darmstadt with the World Climate Research Programme

Conclusion of EUMETSAT's CEOS chairmanship at the Plenary, in Tromsoe

Signature of the Copernicus Agreement with the European Union

The Jason-CS optional programme - EUMETSAT's contribution to the development and implementation of the Sentinel-6 mission - is opened for subscription

The ceiling of the General Budget is approved for the period 2016-2020

Kick-off of the development contract for the Meteosat Third Generation telemetry and telecommand ground stations

Successful Flight Acceptance Review of the Jason-3 satellite and start of the Operational Readiness Review for the full system

The new EUMETCast Europe data broadcasting service implementing the DVBS-2 becomes operational

The extension of the Cooperating State Agreement with Serbia, covering the period 2015-2017, enters into force

MEMBER AND COOPERATING STATES

As it invests in the development of future satellite systems to deliver observations in the 2020-2040 timeframe, EUMETSAT has gained two more Member States, Iceland and Bulgaria, bringing the total to 30.

As foreseen after the ratification of their accession agreements by their parliaments and governments in 2013, Lithuania and Iceland became EUMETSAT's 28th and 29th Member States on 1 and 7 January, respectively.

Bulgaria then completed the ratification of the EUMETSAT Convention and Protocol on Privileges and Immunities and became the 30th Member State on 30 April.

Serbia, the only remaining EUMETSAT Cooperating State, ratified the extension of its Cooperating State Agreement. The agreement entered into force on 16 December for the period until 2017, at which point Serbia is expected to become a full Member State.

In addition, Poland and Iceland ratified the Protocol on Privileges and Immunities.

EUMETSAT MEMBER AND COOPERATING STATES, 1 JANUARY 2015

MEMBER STATES

	SINCE
AUSTRIA	1993
BELGIUM	1986
BULGARIA	2014
CROATIA	2006
CZECH REPUBLIC	2010
DENMARK	1986
ESTONIA	2013
FINLAND	1986
FRANCE	1986
GERMANY	1986
GREECE	1986
HUNGARY	2008
ICELAND	2014
IRELAND	1986
ITALY	1986
LATVIA	2009
LITHUANIA	2014
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
SERBIA	2009

OPERATING COMPLEX SATELLITE SYSTEMS AROUND THE CLOCK

Throughout 2014, EUMETSAT exploited seven satellites in three orbits and delivered observations of weather, atmospheric composition, ocean, land and climate. The availability of all satellite systems has remained very high while the efficiency of operations was increased by innovative evolutions of ground systems.

SAFE OPERATIONS OF THE METEOSAT CONSTELLATION

Meteosat-7, the last first-generation Meteosat satellite, continued to be exploited from 57° East, bridging an important observation gap over the Indian Ocean region. Meteosat-7 will be de-orbited to a graveyard orbit in April 2017.

The three Meteosat Second Generation (MSG) satellites, two of which have exceeded their design lifetime, remained in their nominal orbital positions. Meteosat-10, the latest satellite launched, delivered the primary Full Earth Scan service covering Europe and Africa from 0° longitude, while Meteosat-9 was exploited for the Rapid Scan Service (RSS) over Europe and adjacent seas from 9.5° East. Meteosat-8 served as a hot back-up for both services from 3.5° East.

The Geostationary Earth Radiation Budget (GERB) mission continued to be performed by Meteosat-9, as the de-spin mirror of Meteosat-10's GERB instrument continued to be blocked.

From 4 November, the geographical coverage of the Meteosat-10 SEVIRI High Resolution Visible channel was shifted westwards daily at 17:00 UTC in order to observe the Azores in the visible when the easternmost part of Europe is in the dark, and then moved back to its original position at 00:00 UTC.

Two manoeuvres were performed. The planned East-West station-keeping manoeuvre by Meteosat-8 was brought forward by 10 days, to 25 March, in response to a collision warning received from the Joint Space Operations Center (JSpOC) predicting a conjunction with Skynet-2B on 28 March, with a miss distance of 298 m. The last nominal North-South station-keeping manoeuvre by Meteosat-9 followed on 6 May, while Meteosat-8 was delivering the Rapid Scan Service for 48 hours.

In November, tank heater switching tests were carried out on Meteosat-9 to assess its response to the on-ground thermal control procedures already implemented on Meteosat-8 to compensate for the degradation of its autonomous thermal control system.

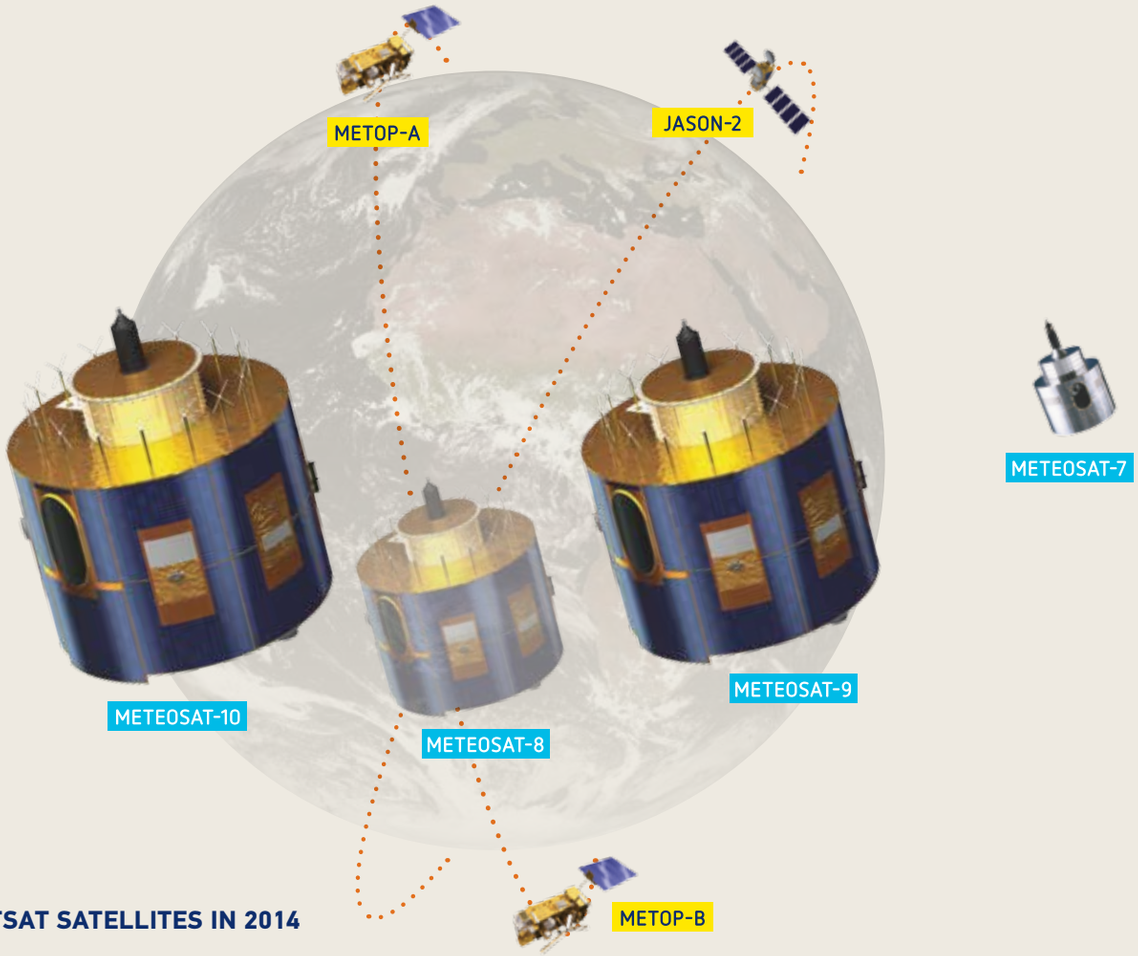
THE DUAL METOP SYSTEM CONTINUES TO DELIVER MAXIMUM BENEFITS DESPITE AN AGEING METOP-A

EUMETSAT exploited its EUMETSAT Polar System (EPS) as part of the Initial Joint Polar System (IJPS) shared with the United States, to collect global, highly accurate observations of atmospheric, ocean and land parameters that are only accessible from low Earth orbits and are critical to forecasts up to 12 days ahead.

The two Metop satellites continued to fly on the same sun-synchronous mid-morning orbit, about half an orbit apart (48 minutes), with their GOME-2 ozone monitoring instruments operating in different modes, i.e. with the full 1,920 km swath and coarse spatial resolution on Metop-B and with a half swath and higher spatial resolution on Metop-A.

Metop-B served as the primary satellite, dumping its data twice per orbit, both at Svalbard and at McMurdo, to deliver global data to users with the shortest possible latency, while the ageing Metop-A served as the secondary satellite dumping data only once per orbit at Svalbard.

Metop-A continued to provide the full set of instrument data, albeit with some significant performance degradations, and full support to the ARGOS localisation and data collection mission.



EUMETSAT SATELLITES IN 2014

METEOSAT SYSTEM			
Meteosat-10	0° East	Full Disc Imagery	Provides the prime Meteosat full disc imagery service over the European continent, Africa and parts of the Atlantic Indian oceans
Meteosat-9	9.5° East	Rapid Scan Service (RSS)	Delivers the RSS over Europe and adjacent seas
Meteosat-8	3.5° East	Meteosat Backup Services	Provides a hot backup for both the full disc and rapid scan services
Meteosat-7	57° East	Indian Ocean Data Coverage (IODC)	Supports the IODC mission, bridging an observation gap in this region

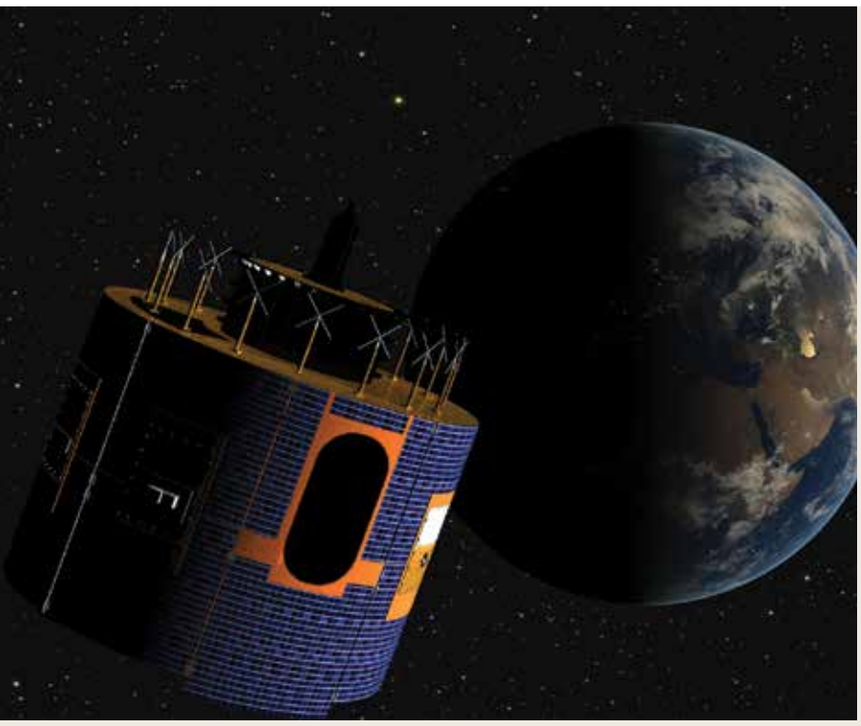
LOW EARTH ORBIT SYSTEMS			
Metop-A	98.7° incl.	EPS	Supports dual-Metop EUMETSAT Polar System (EPS) services from its nominal mid-morning sun synchronous orbit at 817km altitude
Metop-B	98.7° incl.	EPS	Delivers the primary operational service of the dual-Metop EPS services
Jason-2	66° incl.	Ocean Surface Topography Mission	Kept in its nominal non-synchronous low Earth orbit at 1,336km altitude (mission shared with NOAA, CNES, NASA)

The penultimate Metop-A out of plane manoeuvre was performed in two burns, on 26 March and 9 April, respectively. Metop-B had to be manoeuvred on 25 May to avoid collision with debris based on a warning released by JSpOC and had its nominal out-of-plane manoeuvre in October.

Flying on a different, non-synchronous orbit inclined at 66°, the Jason-2 satellite continued to deliver high precision observations of wave height, mean sea level and ocean currents, after more than six years in orbit. The mean sea level data series which started in 1992 with Topex/Poseidon now covers 22 years, constituting an invaluable Climate Data Record.

OPERATING COMPLEX SATELLITE SYSTEMS AROUND THE CLOCK

In 2014, maximising the availability of satellite systems required specific measures and careful management of risks



Artist impression of Meteosat Second Generation in orbit

AVAILABILITY OF SATELLITE SYSTEMS

METEOSAT SYSTEM

The availability of the Indian Ocean Data Coverage (IODC) service performed by Meteosat-7 has been excellent, with only marginal perturbations to image quality around the critical equinox eclipse seasons and a 6.5-hour outage of meteorological products due to a ground segment anomaly.

The availability of all Meteosat services from 0° was very high, as a result of the excellent performance of Meteosat-10 and of twice using the ageing Meteosat-9 and Meteosat-8 satellites to back up this satellite during its decontamination, in January and December, respectively. The only noticeable outages occurred in November and December, due to ground segment anomalies, and did not exceed a couple of hours.

Until March, only two antennas were available to acquire data from three Meteosat satellites, and Meteosat-8 could not be used from 14 January to 10 February to bridge the 28-day winter gap of the Rapid Scan Service (RSS) imposed by the need to operate Meteosat-9 in full scan mode to preserve the lifetime of its SEVIRI instrument. A third antenna became operational again in March, enabling the use of Meteosat-8 to bridge the 48-hour monthly gaps in the Meteosat-9 RSS service, thus bringing the availability of the service back to the highest level achievable with three satellites, i.e. 7% above the level achievable with two. The high availability of the service also owes to the procedures implemented since 2013 to mitigate the impact of the degraded thermal balance of both Meteosat-8 and Meteosat-9 satellites on the geometric quality of their imagery.

The RSS was interrupted for four hours in February, due to a ground segment anomaly, for which a workaround was quickly found. Also, a Single Event Upset (SEU) affected the power supply of the Mission Communication Payload of Meteosat-9 for one hour on 21 July. During critical eclipse conditions in September, the availability of the service fell slightly below the 99% target - to 98.87% - but increased again in the following months after some adjustments.

The second Meteosat lifetime review for the first time assessed the predicted availability of the full disc and rapid scan services as fulfilled by the constellation available in orbit, instead of the predicted availability of each individual satellite. The review concluded that exploiting Meteosat-9 for the RSS as long as possible, until the summer of 2018, and storing Meteosat-11 in orbit for 2.5 years would provide the longest predicted availability of both services, and hence the maximum return on investment for Member States.

LOW EARTH ORBIT SYSTEMS

The availability of the dual Metop EPS system has continued to be very high, even if there was an increasing contrast between the healthy primary Metop-B satellite and the ageing Metop-A.

Metop-B operations were only affected by “space weather” events over the poles and the South Atlantic Anomaly, which caused the loss of one orbit of MHS data in March, 26 hours of IASI data in June, 16 hours of MHS data in July and 5.5 hours of ASCAT data in August. The anomalous noise affecting 12 channels of the HIRS legacy infrared sounder continued to evolve erratically, but the cyclic pattern observed in 2013 did not repeat and the noise stabilized within specifications at year’s end.

Artist impression of Metop in orbit

The ageing Metop-A experienced one significant instrument anomaly, when its MHS moisture sounder entered into fault mode on 26 March, during a satellite out-of-plane manoeuvre, due to an instrument heater unexpectedly remaining switched on. The instrument could only be recovered on 20 May using a modified start-up procedure, after an in-depth risk analysis had demonstrated the procedure was safe.

The GOME-2 instrument went into "refuse" mode on 21 January due to a space weather event over the South Pole region but was rapidly recovered, on 23 January.

The noise of the AMSU-A1 microwave temperature sounder's channels 3 and 8 has continued to increase well above out-of-specification limits and channel 8 has reached the noise level that made channel 7 unusable in 2009. The noise of channels 3 and 4 of the MHS moisture sounder also continued to increase, but with different characteristics after the instrument recovery from failure.

The production of Metop level 0 data acquired at Svalbard was interrupted for four hours during an outage of all terrestrial communications with the Norwegian mainland on 2 June. The "backlog" Metop raw data acquired and recorded at Svalbard during the outage were processed and archived in July and measures were agreed with the service provider to make the system more resilient. Other ground segment anomalies caused the loss of 1.5 hours of Metop and NOAA-19 data on 26 March.

The EPS lifetime review for the first time assessed the predicted availability of the imagery and sounding missions as performed by a two-satellite system, concluding that Metop-A should have enough fuel for exploitation until the end of the commissioning of Metop-C, in 2019.

The availability of Jason-2 data services remained excellent throughout the year. The root cause of the permanent error in one of the satellite's nominal processor module units is still under investigation.

Artist impression of Jason in orbit

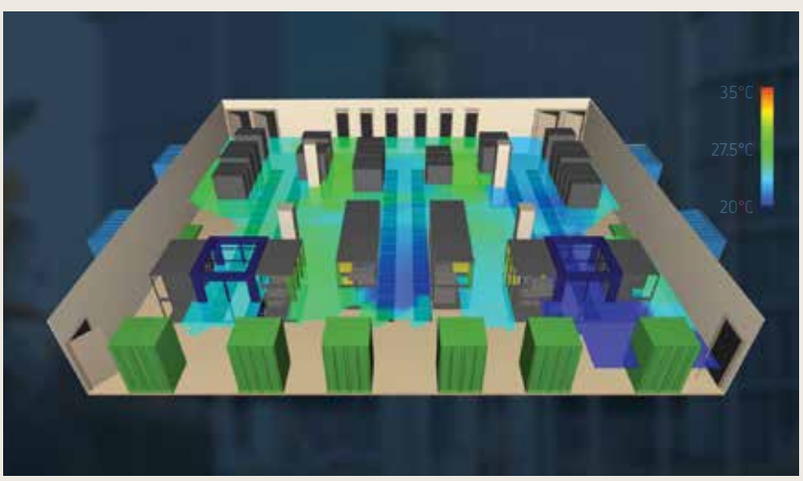
MODERNISED GROUND SYSTEMS INCREASE EFFICIENCY AND RESILIENCE OF OPERATIONS

The year 2014 saw the completion of a first cycle of infrastructure set-up and re-engineering of ground systems aimed at increasing operational efficiency and resilience while minimizing EUMETSAT's CO_2 footprint.

The set-up of the generic technical infrastructure inside the Technical Infrastructure Building (TIB) was completed in December. This was the result of key milestones achieved earlier, starting in June with the operational readiness of the new storage network infrastructure (SNI) which provides networking of a growing number of specific and multi-mission systems. The design and fully redundant, highly scalable and flexible architecture of the SNI support gradual migration to 10 gigabit ethernet server ports, link aggregation, virtualisation, "cloud" storage services and secure service continuity even in the case of a complete loss of one building floor.

The flexible and configurable connectivity between the servers of the TIB and all the terminals installed in the control rooms of the main building was then established through the implementation of the multi-mission control centre network, in preparation for upcoming installations related to new programmes.

The data centre infrastructure management tool was fully implemented in the TIB and now collects readings of power consumption and temperature sensors for every rack. This allows energy savings through tuning of cooling to the minimum level and risk prevention through early identification of any local overheating.



Real-time temperature map in a TIB server room, generated by temperature sensors connected to EUMETSAT's Data Centre Infrastructure Management tool, help optimise cooling. Cool and warm areas appear in blue and green respectively.

The resilience of operations against a loss of power on one floor of the TIB was demonstrated by tests showing that IT systems continue to work nominally using resources available on another floor, and resilience against the total loss of one floor (e.g. for fire) was confirmed by a comprehensive analysis.

The MSG end-to-end data processing chain was migrated to a new virtualised environment in the TIB and replaced the legacy systems. Decoupling software from hardware, this virtualisation enabled the hosting of the full chain on two computer racks instead of 15, thus reducing power consumption by a factor of six, while offering the capacity to process four instead of three data streams. The system became operational on 4 November for the processing of Meteosat-8, -9 and -10 data. The last element of the MSG ground segment, the Control Centre, will be virtualised in 2015, after the commissioning of MSG-4.

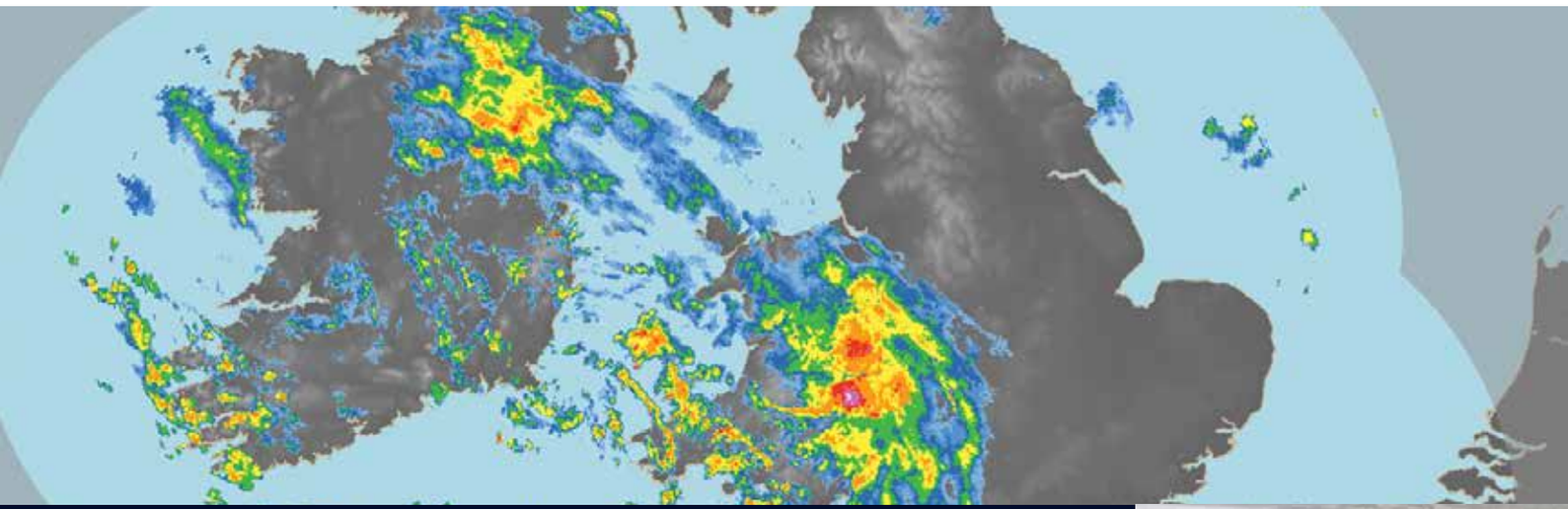
A strategy was established to optimise the usage of the Meteosat antennas hosted in Usingen and Fucino to support operations of four satellites in 2015-2021 and then reduce their number to adjust capacity to a decreasing number of satellites as the oldest ones are de-orbited. For the sake of cost efficiency, one of the two sites will be selected through a competitive process to host the remaining antennas.

The EPS Control Centre re-engineering project, aimed at restructuring the software around multi-mission kernels, concluded the design phase for the flight dynamics facility and started the design of the mission planning facility. Meanwhile, the EPS Back-up Control Centre was relocated within the INTA (Instituto Nacional Técnica Aeroespacial) site near Torrejon, Spain, to increase efficiency through the sharing of resources with other programmes.

After validation, the new Multi-Mission Dissemination System that consolidates all near-real-time data dissemination facilities into one started to be used to feed data streams into the new EUMETCast-Europe broadcasting service implementing the more efficient DVB-S2 standard. The new service started operations on 14 August and was declared operational on 15 December, after being run in parallel to the DVB-S service. The new service cuts the annual cost by 50% and doubles bandwidth capacity. Guidelines for user migration were published on the EUMETSAT web site and discussed at a dedicated forum gathering around 75 users and eight station manufacturers.

Prospective studies were launched to assess the relevance of cloud and other "big data" technologies to emerging user needs for secured information-centric data services.

DELIVERING SERVICES AND BENEFITS TO REAL-TIME USERS

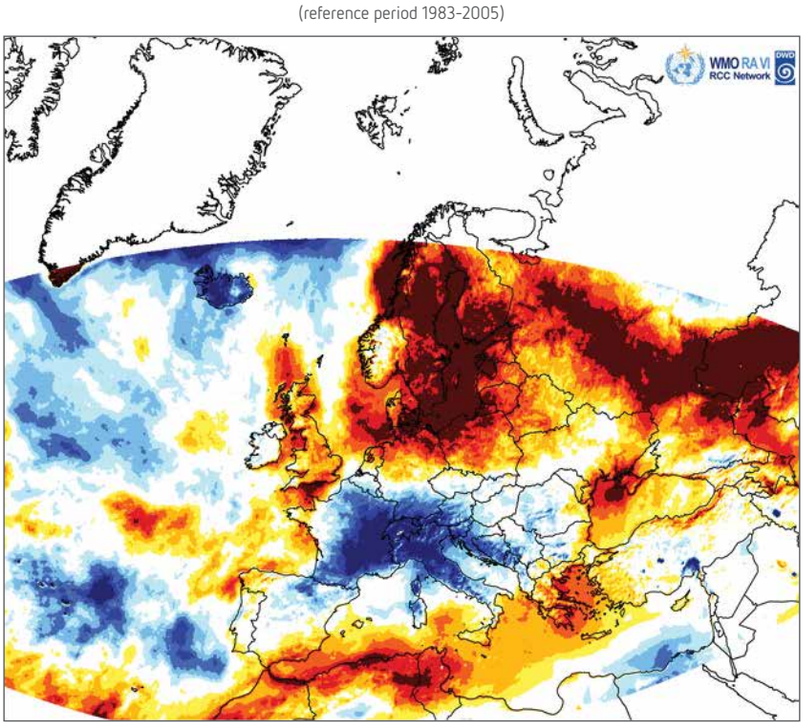


Once again, EUMETSAT data services were essential for forecasting high impact weather across all ranges, bringing benefits to citizens, decision-makers and the weather-sensitive sectors of Member States' economies.

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.

2014 was a year with above-average precipitation across Europe, with several major record-breaking floods in many countries, both in winter and summer. England and Wales had their wettest winter for 250 years and 2014 was the worst year in history for olive oil production in Italy - with a 35% drop in yield – partly due to unusually moist and cold weather.

Absolute anomaly Direct Radiation (surface) July 2014
(reference period 1983-2005)



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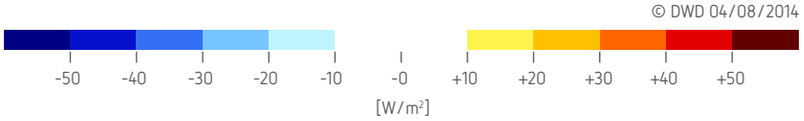
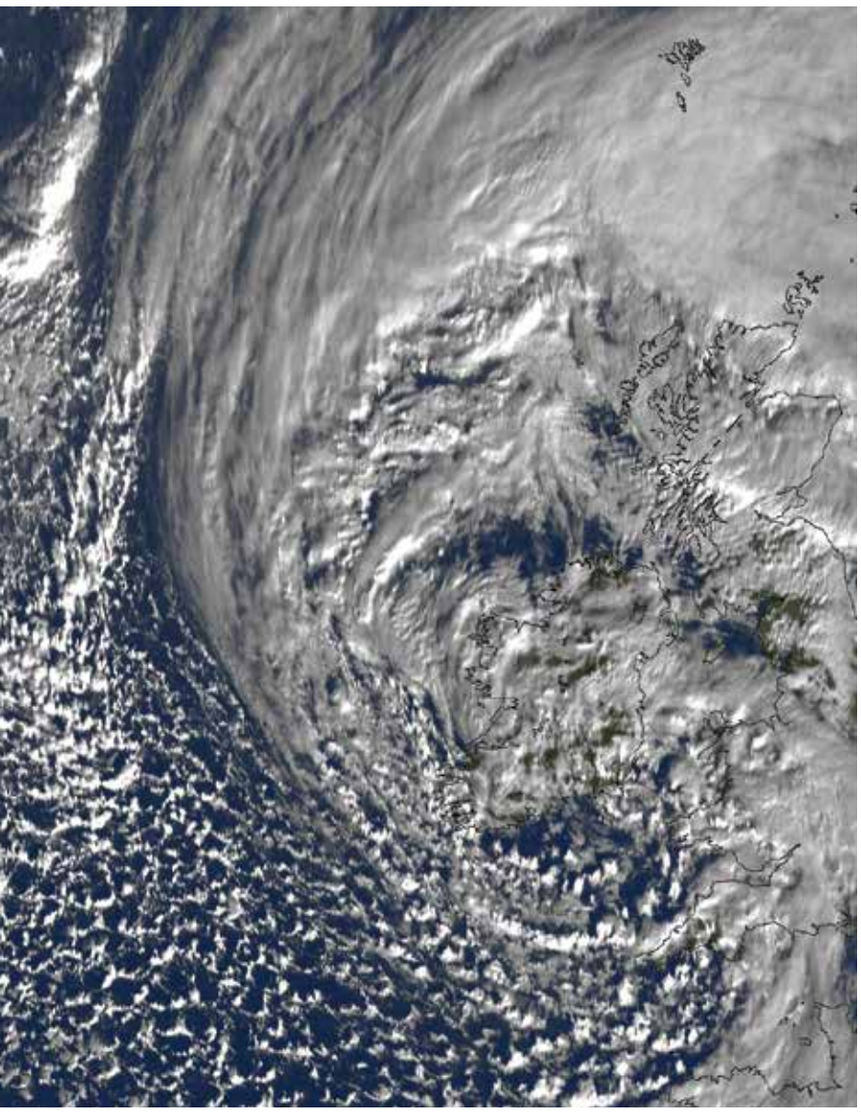


In a year marked by high precipitation, large parts of France and Italy had also significantly fewer sunshine hours than average (source: CM SAF)



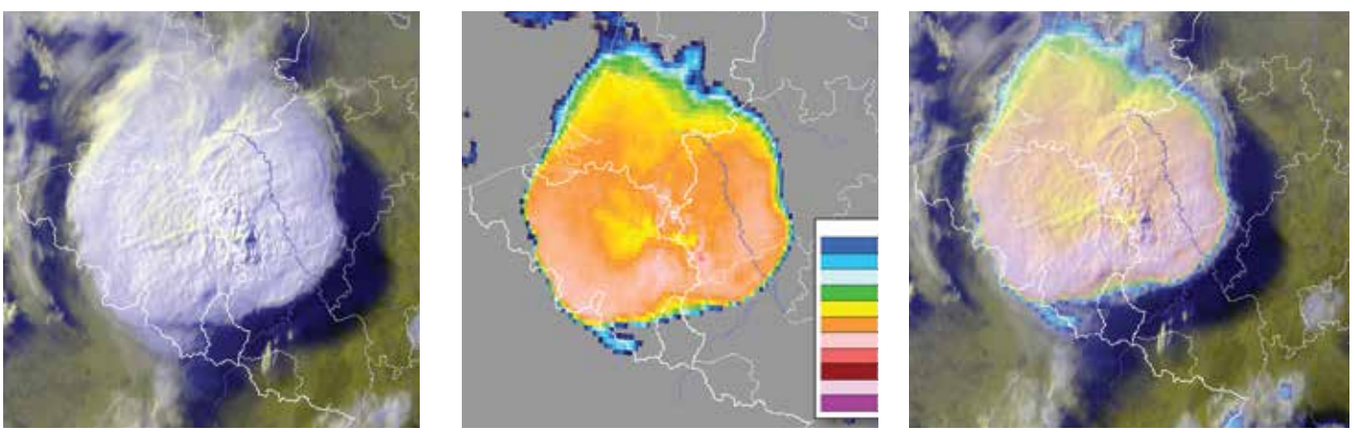
Meteosat visible image (5 February 2014 10 Z) of one of several major storms hitting western Europe. Associated flooding and landslides closed all rail routes from London to south-western England and the River Thames burst its banks.

METEOSAT IMAGERY CENTRAL TO SHORT-RANGE FORECASTING OF SEVERE WEATHER

Early in 2014, a succession of winter storms caused severe flooding and damage in France, Portugal, Spain and the UK and the heaviest snowfall for decades in Slovenia, Bulgaria, Croatia, Italy, Austria and Switzerland. Meteosat imagery was used in real-time by forecasters to confirm their forecast scenario and issue early warnings for these events.

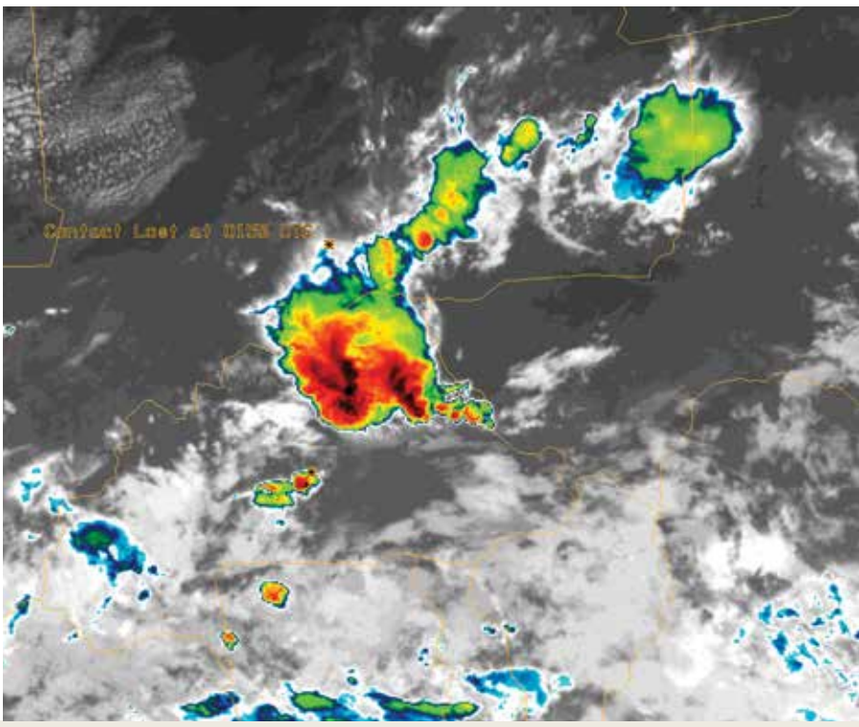
In the spring and summer, weather services in Central and Southern Europe were mobilised by low pressure and convective systems causing flooding and damage. In June, forecasters in Germany, France and the Benelux used Meteosat imagery for nowcasting "super

Nowcasting a "super cell" in Germany: Meteosat visible information (top left) on the texture of clouds and infrared information on cloud top temperature (top right) are combined into a "sandwich" product (bottom) to characterise the intensity and development of the cell (source: DWD)



cells" bringing a combination of severe thunderstorms, large hailstones and flash floods and issuing timely warnings to decision-makers, event organisers and the public.

On 24 July, the crash of Air Algérie flight 5017 over Mali recalled that weather can be an important factor for avaiation and that having Meteosat image loops in cockpits could help airline pilots appreciate the intensity and extension of severe convective systems beyond the range of their radars. Processed imagery can indeed detect dome-like protrusions above "overshooting" cumulonimbus clouds with strong updrafts associated with dangerous turbulence, hail, high winds, lightning and heavy rainfall. For such rapidly evolving systems, the use of satellite imagery for flight preparations is not enough.



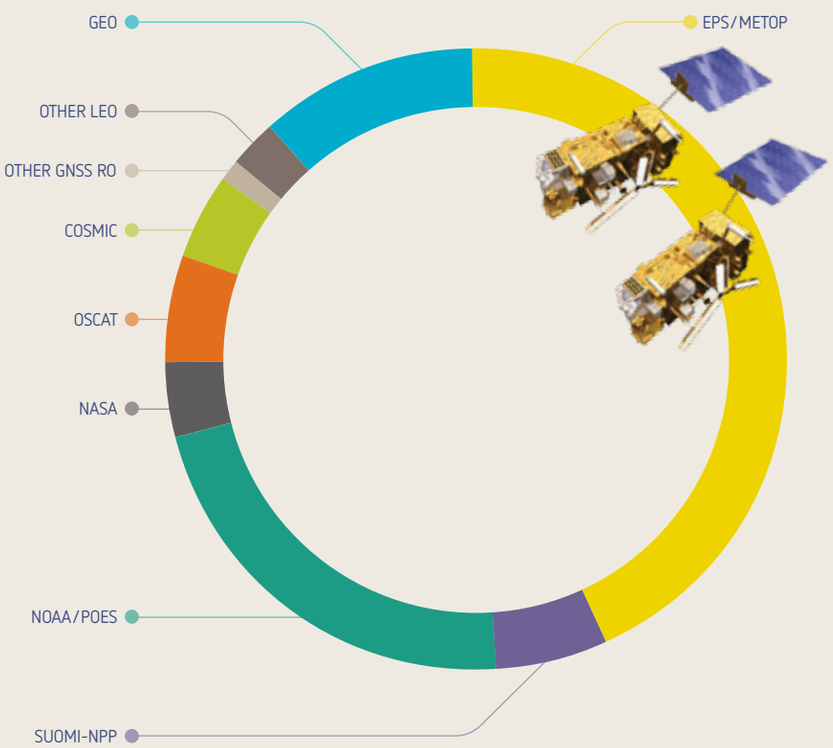
Meteosat-10 colour coded imagery showing severe convective systems moving westwards over Mali on 24 July, when contact was lost with Air Algérie flight 5017

NEW EVIDENCE OF HIGH IMPACT OF EPS/METOP ON NUMERICAL WEATHER PREDICTION

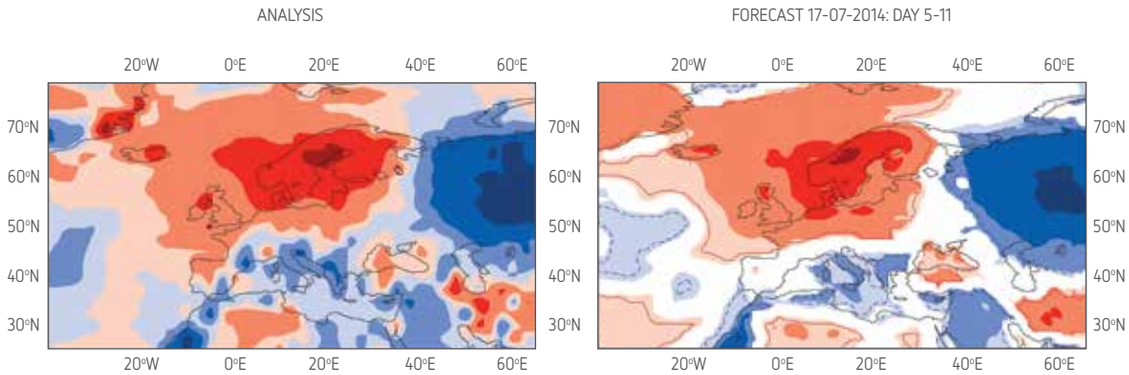
Global and regional Numerical Weather Prediction (NWP) models, used by forecasters as the main source of information for forecasts from 12 hours to 12 days ahead, rely mainly on global observations from polar-orbiting satellites like EUMETSAT's Metop spacecraft.

Observations of the ocean from Metop and Jason-2 satellites are also used for forecasting sea state and dispersion of marine pollutants and for seasonal forecasting.

Observations from both Metop satellites continued to be the most important observational inputs ingested by models, as demonstrated this time by new statistics produced by Météo-France, one of the three European Meteorological services exploiting a global model for short range forecasting, showing that dual Metop observations have the largest impact by far on the quality of their Day-1 numerical forecasts.



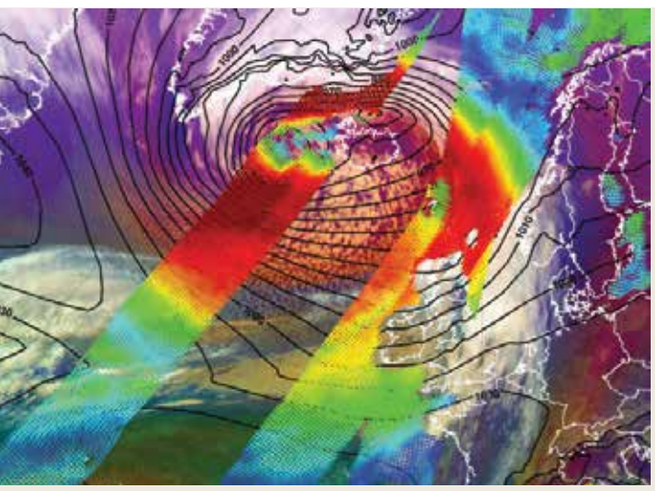
Relative contributions to the reduction of day-1 forecast errors from all satellite observations ingested in Météo-France's ARPEGE global model. The dual Metop EPS system scores 44% and the full IJPS (Metop, NOAA, NPP) 72%. (source: Météo-France)



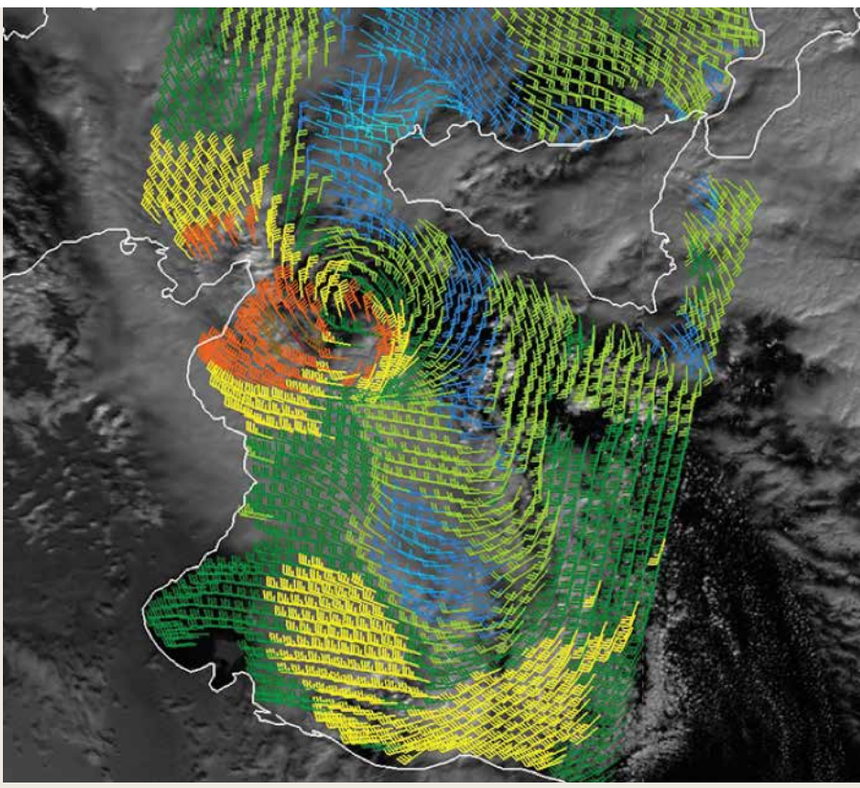
ECMWF probabilistic forecast (right) of temperature anomalies up to 10 degrees one week before a heat wave hit the Nordic countries in July, compared to the conditions actually observed (left). These forecasts involve models coupling ocean and atmosphere and ingesting data from both Metop and Jason-2. (source: ECMWF)

Metop data have improved forecasting and early warning of the large scale high impact weather events recorded in 2014, from severe storms in Western and Central Europe to the heat waves in July over Northern Europe which caused record-breaking temperatures in Norway, Denmark and Sweden, with one heat wave lasting from 17 to 30 July.

Also remarkable was a tropical-like hurricane known as a "medicane" that hit Sicily on 7 November - with gusts of 135 km/h recorded at Lampedusa - causing the suspension of airport and ferry operations and leaving many areas without power.



Forecast of winter storm Alexandra overlaid with Meteosat imagery and Metop/ASCAT winds on 9 December. With a central pressure of 950 hPa and winds, Alexandra brought gusts of 129 km/h and ocean waves over 15 m in North-Western Scotland.



Structure of a medicane depicted by Metop-B imagery over Sicily on 7 November. AVHRR infrared imagery is overlaid with the coastal wind field (wind speed is colour coded, from blue to orange) extracted from ASCAT scatterometer observations.

DATA ACCESS AND REAL-TIME DELIVERY

EUMETSAT ground station in Svalbard

The EUMETCast service continued to broadcast time-critical data to users with 99.9% availability, while the data services from the Initial Joint Polar System were improving in scope and latency, as the Suomi-NPP satellite and the Antarctic Data Acquisition service gained operational status on the NOAA side.

One challenge for EUMETSAT is to deliver observational products as quickly as possible after sensing - because the value of observations for forecasting diminishes with increasing latency - and to offer the easiest possible access to users worldwide.

AVAILABILITY OF EUMETCAST SERVICES REMAINS 99.9%

EUMETSAT broadcasts its real-time products to users distributed over Europe, Africa and the Americas, using the highly reliable, flexible and cost effective satellite-based technology used for digital TV broadcasting.

The availability of the EUMETCast-Europe, -Africa and -Americas services remained at record high levels throughout 2014 - above 99.9% for EUMETCast Europe - with no significant outage.

The availability of internet services to users was also high, but was interrupted on 13 August by a power outage in a rack hosting the Operational Internet Service (OIS) servers, which left no possibility to notify users. A back-up user notification service (UNS) usable when the OIS is down is being developed for implementation in 2015, together with a new nominal online UNS incorporating both an email alert service and a web display interface.

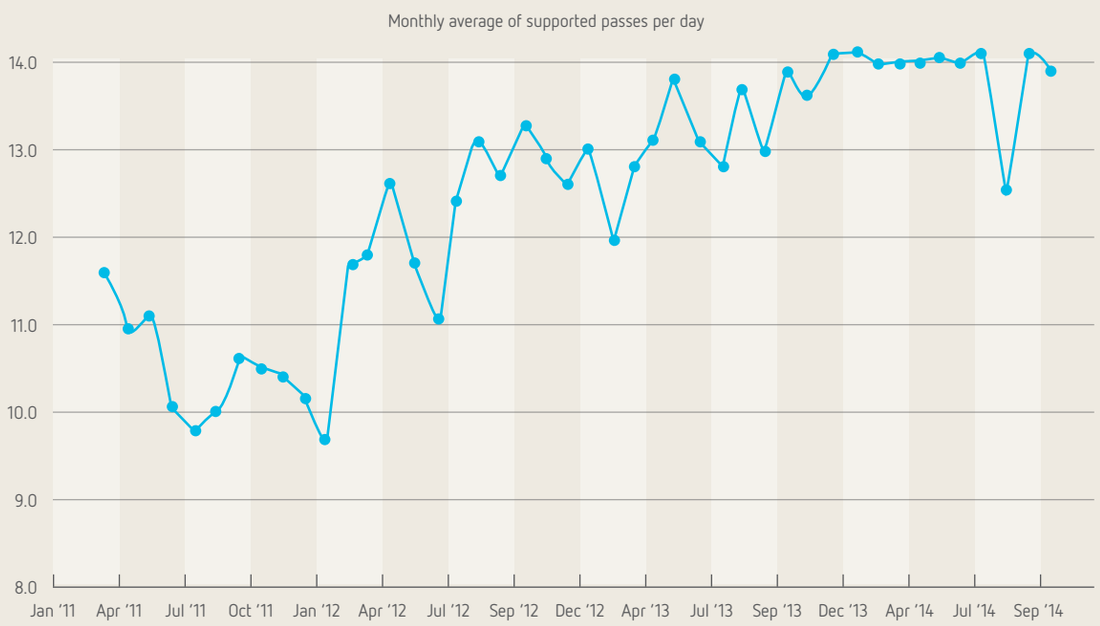
A user satisfaction survey provided very positive feedback on how user enquiries are handled.

MORE METOP-B PRODUCTS BECOME AVAILABLE WITH SHORTEST POSSIBLE LATENCY

While geostationary imagery needs to be disseminated within minutes of sensing, global data from polar-orbiting satellites have less stringent latency requirements, and are acquired only when satellites dump on-board recorded data to ground stations. If located at very high latitude, one station can acquire data at each orbit cycle, every 100 minutes, around 14 times a day, but more time is then needed to extract products to be broadcast via EUMETCast.

Within the Initial Joint Polar System (IJPS) shared with NOAA, Metop-B data are acquired twice per orbit by EUMETSAT at Svalbard, Spitzbergen, and by NOAA at McMurdo, Antarctica, cutting latency by two, to 50 minutes. In 2014, the Antarctic Data Acquisition (ADA) service became fully operational, providing, in combination with the Svalbard acquisition service, the shortest possible latency for almost 100% of Metop-B products.

US-provided McMurdo ground station in Antarctica, where Metop-B data are acquired



The US-provided ADA service acquired almost all 14 Metop-B passes per day over Antarctica. The only noticeable outage occurred from 20 to 23 August due to a power outage in McMurdo that could not be repaired immediately due to adverse weather conditions.

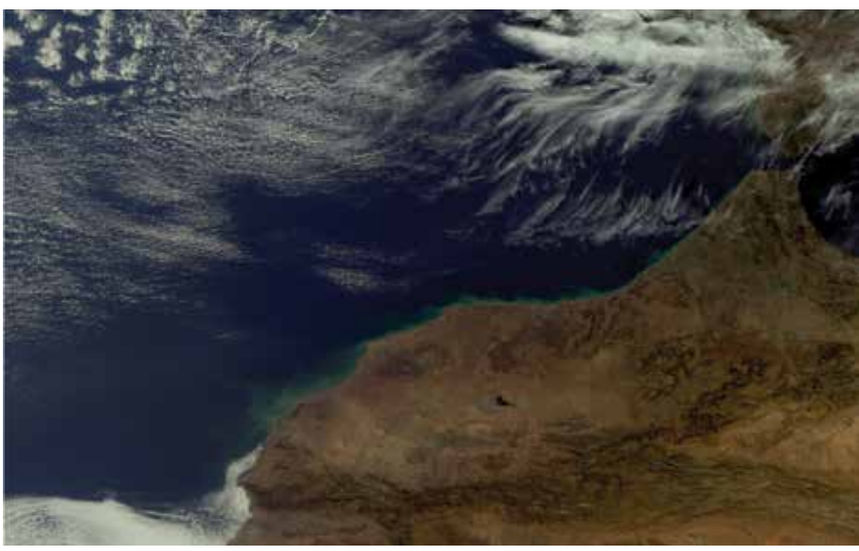
EARS REGIONAL DATA SERVICES BECOME FULL IJPS SERVICES

The EARS (EUMETSAT Advanced Retransmission Services) regional data services deliver products from polar-orbiting satellites with an even shorter latency of 15 to 30 minutes from sensing, through the local processing, collection and redistribution of sounding and imagery data acquired directly from the satellites at a few ground stations. This short latency, combined with more frequent observations available from multiple satellites, makes products usable for nowcasting over Europe.

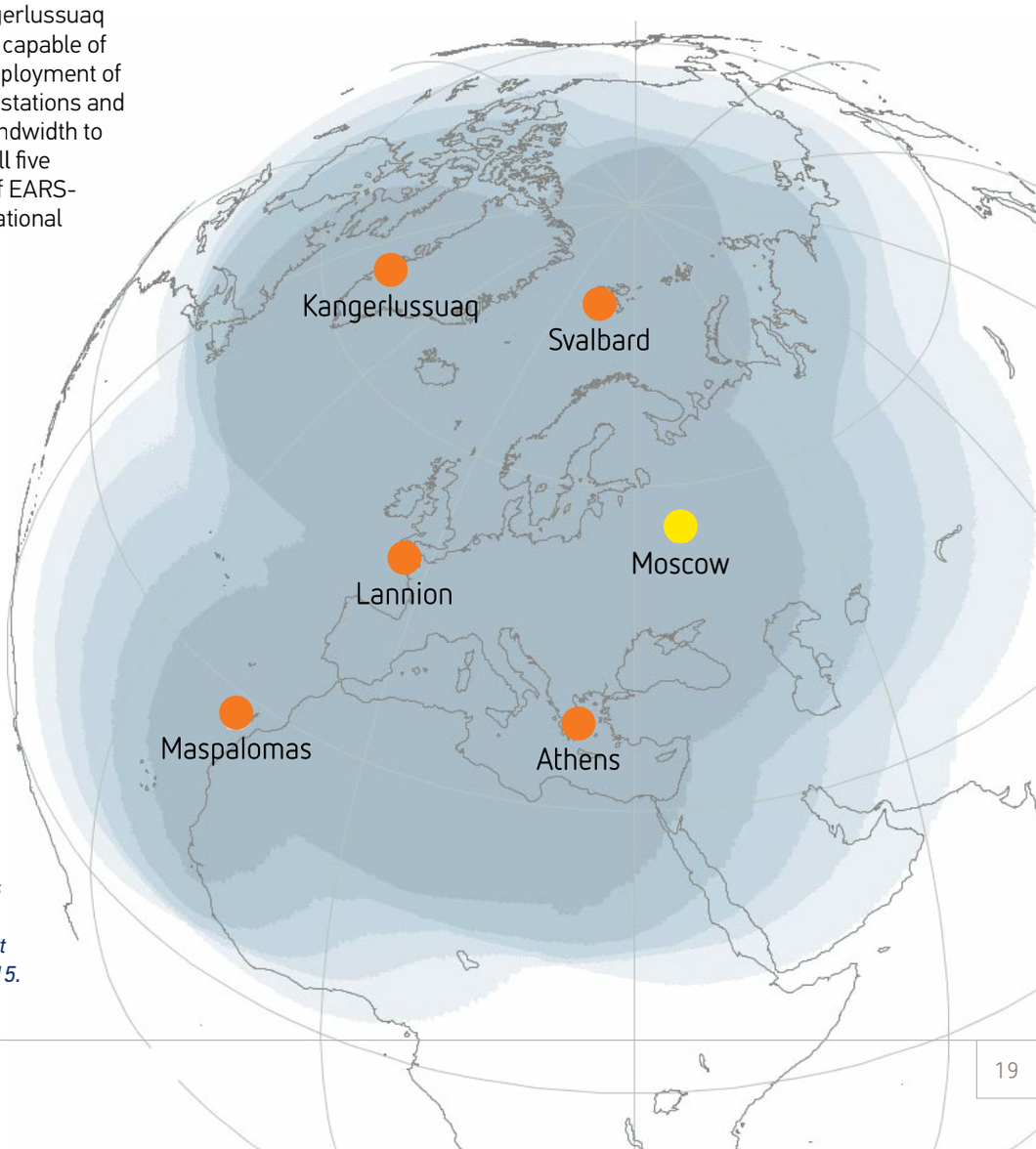
A major achievement of 2014 was the full integration of products from the US Suomi NPP satellite into the EARS service, which is now a true IJPS regional service using imagery and sounding data acquired from the mid-morning and afternoon polar orbits at Lannion, Athens, Svalbard, Kangerlussuaq and Maspalomas.

This required the addition of Kangerlussuaq to the network of X-band stations capable of acquiring Suomi NPP data, the deployment of VIIRS imagery processors at four stations and an increase in communication bandwidth to retrieve imagery products from all five stations. As a result, the full set of EARS-Suomi NPP services gained operational status in December.

The coverage of some EARS-Metop services was extended with the inclusion of data acquired at Kangerlussuaq, Moscow, Muscat and upgrades of local processing software improved the quality of products extracted at all stations.



VIIRS image acquired at Mas Palomas



The IJPS regional data service over Europe at the end of 2014. All stations marked in orange deliver Suomi NPP and Metop products. Moscow will start delivering Suomi-NPP products in 2015.

DELIVERING CLIMATE SERVICES

At the core of the "observation and monitoring" pillar of the Global Framework for Climate Services, meteorological satellites build the longest records of our changing climate from space. EUMETSAT continued to recalibrate and reprocess historical data but also developed methods for assessing the maturity of Climate Data Records (CDRs), as part of a pan-European effort to bring climate services to operational status.

EUMETSAT's climate monitoring activities involve the archiving and data processing infrastructure and the expertise available at its central facilities in Darmstadt and across its network of Satellite Application Facilities (SAFs), in particular at the Climate Monitoring SAF hosted by Deutscher Wetterdienst (DWD).

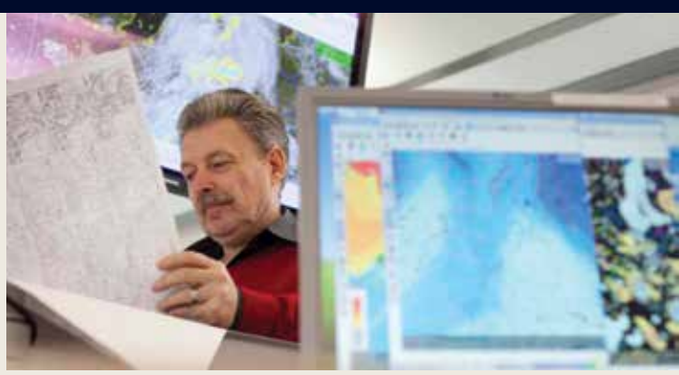
The activities encompass recalibration and cross-calibration of archived satellite observations, production of homogeneous Fundamental Climate Data Records of physical parameters (e.g. radiance, reflectance, radar backscatter) and downstream reprocessing of series of geophysical parameters (e.g. temperature, wind) forming Thematic Climate Data Records of Essential Climate Variables. Validation and quality assessment are involved at all steps.

EUMETSAT CDRs can then be used directly for climate analysis or ingested into the best Numerical Weather Prediction models used in "reanalysis" (hindcast) mode to produce consistent records of a broader range of climate variables.

COOPERATIVE PROJECTS

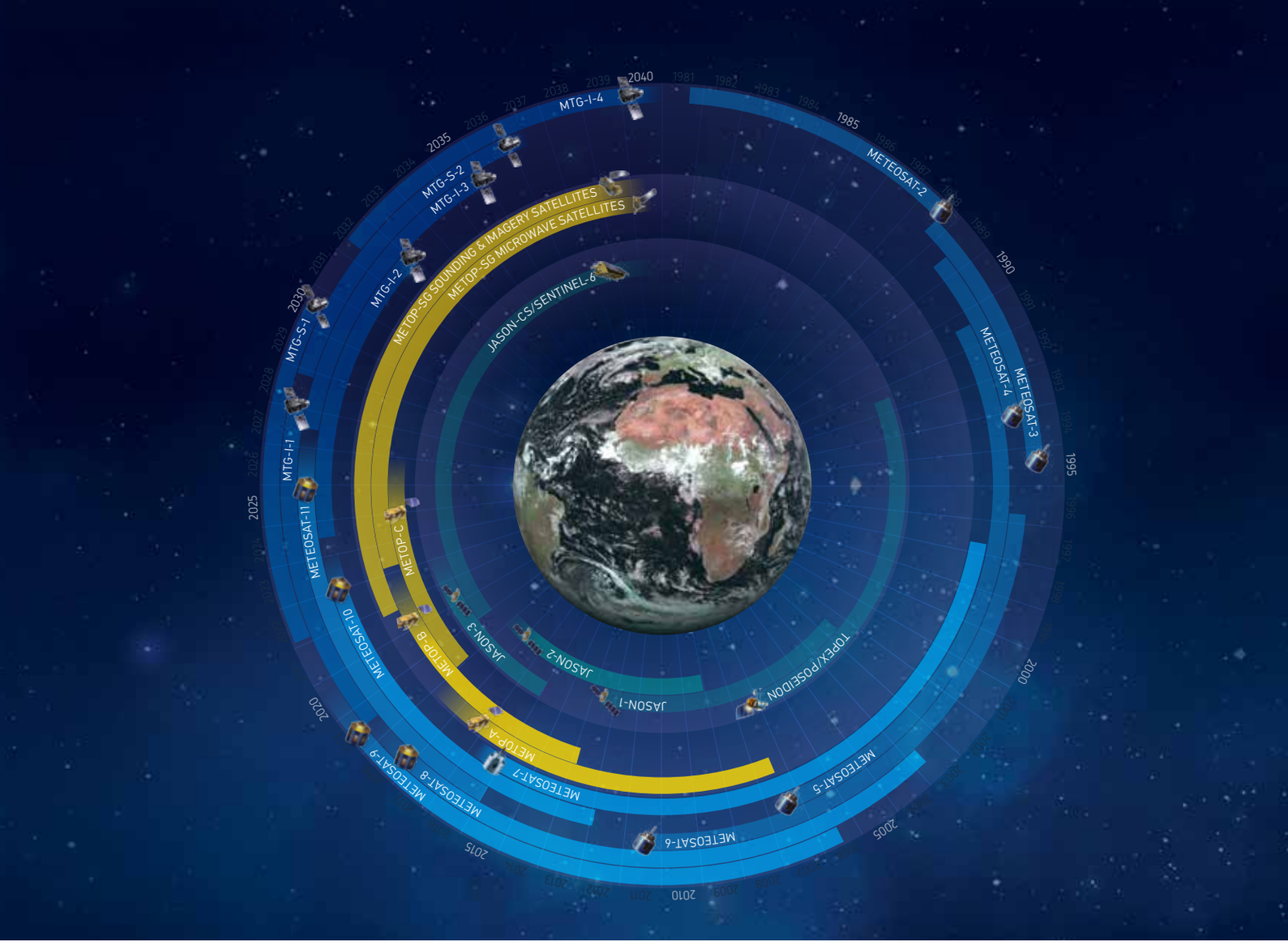
In 2014, EUMETSAT's participation in international cooperative projects focused on the development of methods for assessing the maturity and uncertainties of CDRs.

Within the Seventh Framework Programme for research and technological development (FP7) CORE-CLIMAX project, EUMETSAT proposed and tested methods and metrics for assessing and qualifying the maturity of CDRs that were recommended for use by the Copernicus Climate Change Service (C3S). As a partner of the FP7 QA4ECV (Quality Assessment for Essential Climate Variables)



project kicked off in 2014, EUMETSAT supports the assessment and traceability of the uncertainties attached to the production of a new CDR of surface albedo combining observations from polar and geostationary orbits. At this early stage, EUMETSAT provided its existing Meteosat surface albedo CDR to support the development of algorithms combining data from both orbits.

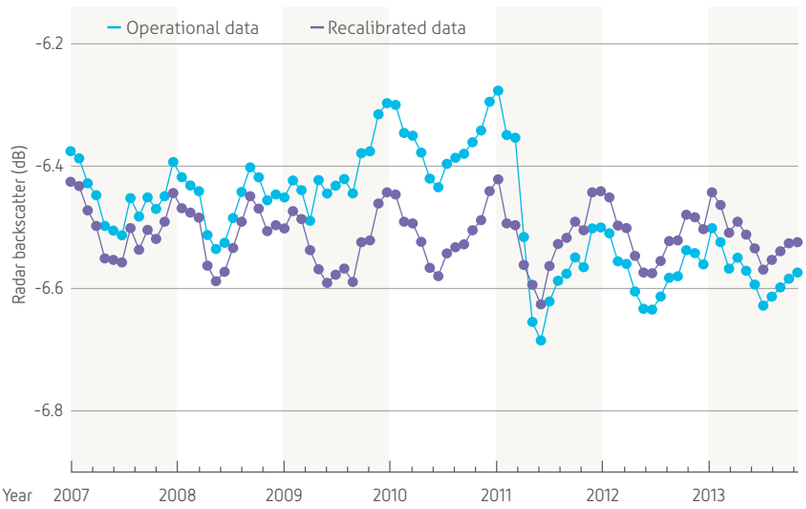
EUMETSAT also joined two new Horizon 2020-funded projects addressing validation and assessment of climate records. FIDUCEO (FIDelity and Uncertainty in Climate data records from Earth Observations) will use metrology to characterise uncertainties in the creation of new records, while GAIA-CLIM (Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring) will assess uncertainties of space-based measurements used as inputs to the production of CDRs, through their cross-calibration and validation against historical ground-based references. EUMETSAT will deliver climate records from Meteosat first generation and heritage infrared sounders to FIDUCEO and construct a so-called Virtual Observatory for GAIA-CLIM that enables comparison of satellite data records, ground-based measurements and reanalyses, taking into account estimated uncertainties of all records.



RECALIBRATION OF HISTORICAL DATA

The recalibration of historical data focused on cross-calibration of Meteosat infrared imagery and recalibration of radar backscatter measurements from the Metop satellites' ASCAT scatterometers.

The strategy for cross-calibrating Meteosat infrared imagery in the period 1982 to today against IASI reference data only available since 2006 was consolidated. Long infrared data records (from the NASA AIRS sounder and the NOAA series of HIRS-2 instruments) overlapping with IASI data were identified for propagating backwards in time the excellent cross-calibration achievable with IASI and was used to bridge the eight-month gap between both data records. Then the stability over time of the HIRS-2 data record started to be assessed to confirm their possible use for backward propagation to 1982, over the long period where neither IASI nor AIRS reference data are available. In this regard, the comparison of data from the NOAA-14 satellite's HIRS-2 instrument with AIRS reference data, back to 2002, did not identify any drift in HIRS-2 data. Cross-calibration coefficients are now being calculated backwards using all HIRS-2 instruments over the 2002-1982 period, with the expectation that their consistency over time will shed light on the stability of the instruments flown before 2002.



Radar backscatter signature of the tropical rainforest measured by ASCAT real-time products (blue) and products recalibrated against ground transponder data (purple). Recalibration eliminates drifts and jumps in the time series, which now reflects only the natural variations of the backscatter of the forest canopy.

The radar backscatter measurements of the ASCAT instruments were recalibrated using reference data from calibration transponders deployed in Turkey, and the resulting improvements were validated by comparison with the known backscatter properties of the tropical rainforest.

DELIVERING CLIMATE SERVICES

The production of Climate Data Records, based on the reprocessing of re-calibrated observations using the best algorithms, is the raison d'être of EUMETSAT's climate monitoring activities.

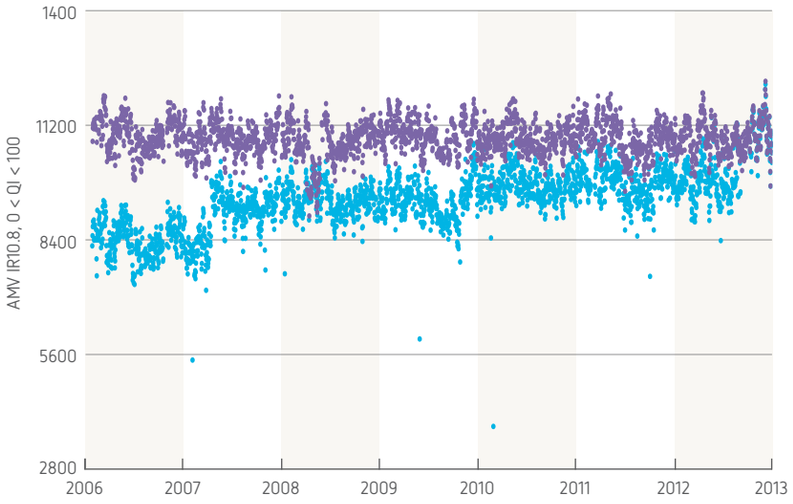
PRODUCTION OF FUNDAMENTAL CLIMATE DATA RECORDS

The downstream production of Fundamental Climate Data Records focused on improving existing Metop records, taking advantage of recalibration and new processing algorithms.

A second release of the ASCAT radar backscatter (level 1b) data record covering the period 2007-March 2014 was delivered to the ERA-CLIM reanalysis project and ultimately to all users, after confirmation of its excellent quality through validation efforts.

Vertical profiles of bending angle from the GRAS radio-occultation instrument were also reprocessed over the same period using geometrical optics theory, and validation showed superior performance to the real-time product. A second version of the processing software implementing wave optics theory was implemented to further improve the quality of reprocessed products in the lower troposphere.

Number of wind vector products extracted from Meteosat imagery with a quality index above 80%, for reprocessed (purple) and real time products (blue) in the period 2005-2013. Over the entire period, reprocessing brings the number of high quality products to the highest level achieved in real time (in 2013).

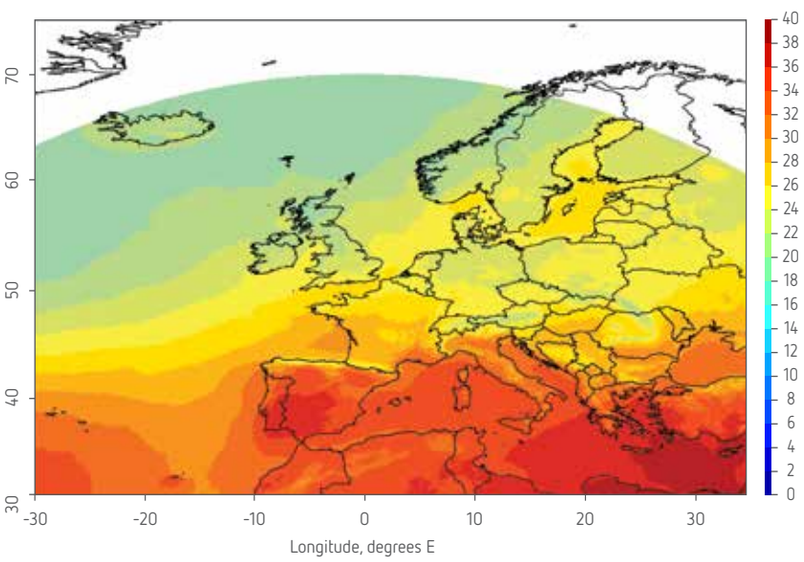


PRODUCTION OF CLIMATE RECORDS OF ESSENTIAL CLIMATE VARIABLES

The production of Thematic Climate Data Records (TCDRs) concentrated on the reprocessing of Meteosat Second Generation meteorological products, including wind products (Atmospheric Motion Vectors), over the period 2004-2012. The validation showed that the TCDR contains significantly more high quality wind vector products then the archived series of operational products.

The CM SAF released a daylight CDR derived from Meteosat visible imagery for the period 1983 to 2011 available as daily means with a spatial resolution of 0.05° x 0.05°. It also developed a robust cloud detection algorithm ("cloud mask") using only two Meteosat spectral channels, which is hence usable for the full series of recalibrated observations from both generations of satellites. A first CDR of this cloud mask over the period 2004-2012 was tested within the Q4ECV project, prior to its integration into the reprocessing of Meteosat albedo products. This cloud mask will be essential for the production of CDRs of all ECVs related to cloud processes and observable from space only in cloud-free conditions, like surface albedo.

The O3M SAF released a CDR on Lambertian Equivalent Reflectance derived from GOME-2 observations covering the period 2007-2013.



Highest intensity of daylight in summer derived from Meteosat imagery over the period 1983-2011, varying from 30–40 kLux over the Mediterranean to 18–24 kLux in north-western Europe.

UPGRADE OF IT INFRASTRUCTURE

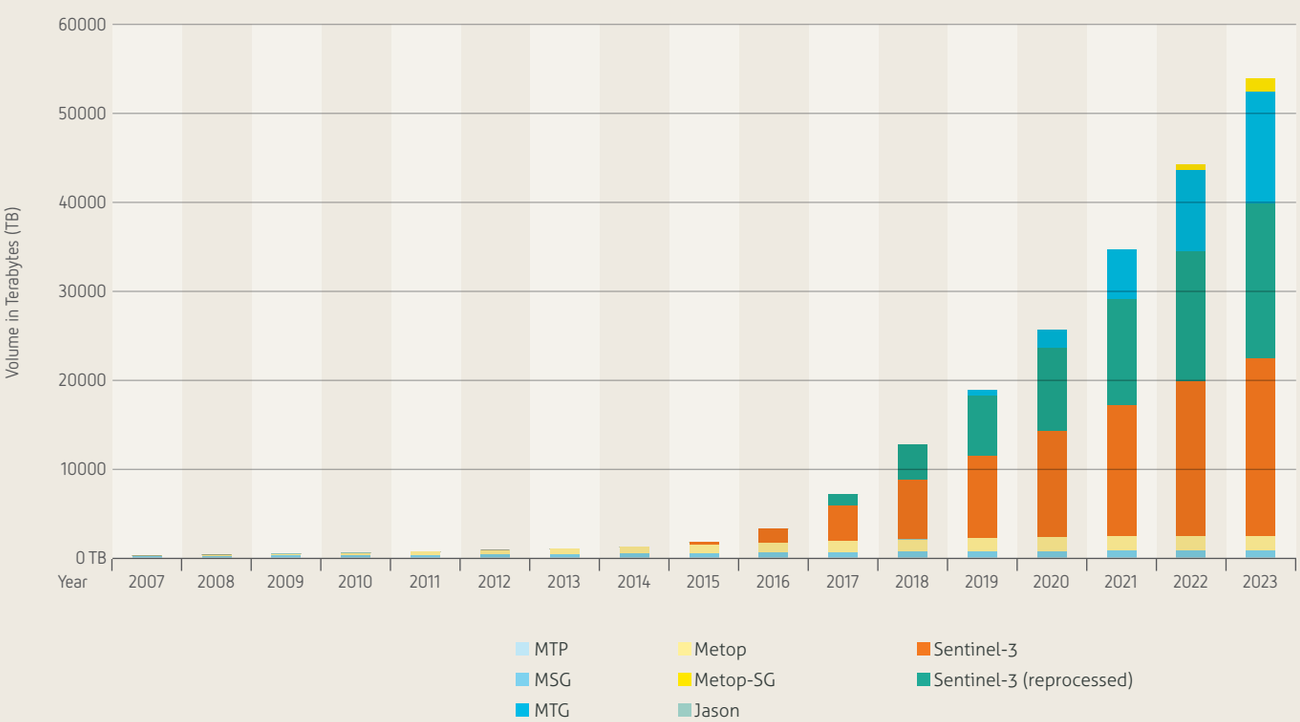
The IT infrastructure needs continuous adaptation for data preservation and fast reprocessing of increasingly large data volumes

After the transfer of all tapes, the new high capacity (10,000 slots) tape library installed in 2013 became operational at the end of 2014 with an availability of 99.996%. The system brought the current archiving capacity from 17.5 to 50 Petabytes (PB) and is scalable to archive up to 200 PB. It will thus cope with the increasing volume of EUMETSAT and Copernicus mission data - starting with Sentinel-3 - from the 1.3 PB stored at the end of 2014 to 100 PB in 2025.

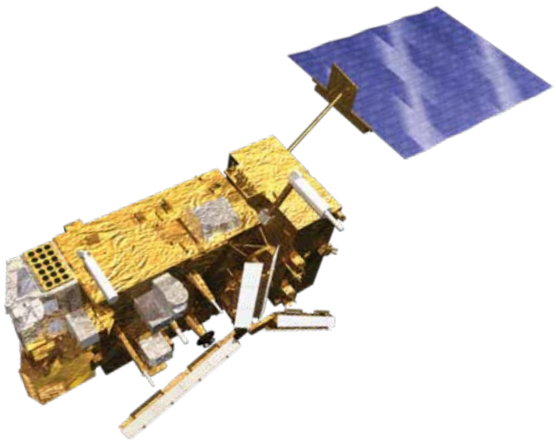
Algorithms used to extract Climate Data Records from archived data are becoming increasingly complex, involving more and more sophisticated representation of measurement physics for a given instrument, or combining information from different sensors and satellites. Thus, IT infrastructure needs to be upgraded to offer flexible access to large datasets and to increase computer power for mass re-processing.

The requirements for the next infrastructure upgrade were consolidated in 2014, ahead of the implementation planned in 2015.

Planned evolution of the volume of the EUMETSAT archive



DEVELOPING ENHANCED AND NEW PRODUCTS IN COOPERATION WITH MEMBER STATES AND INTERNATIONAL PARTNERS

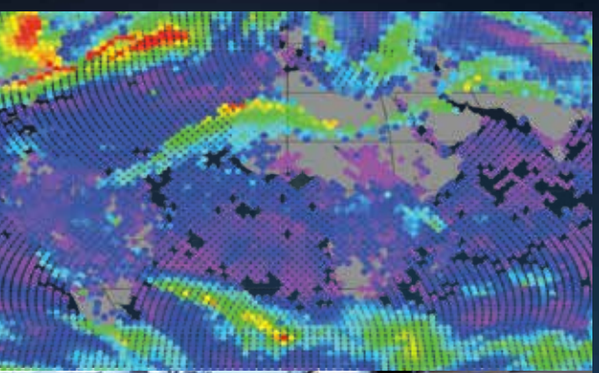


Cooperative development involving the network of Satellite Application Facilities brought new operational products, including innovative multi-sensor and multi-satellite products, and prepared for more in the future, for the benefit of a broad range of applications.

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.

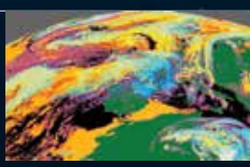
This network allows the best use of distributed expertise and resources for the development and delivery of innovative products, capitalising on scientific expertise, close interactions with application experts and cross-network cooperation.

In 2014, the contributions of the central facilities and the SAF network to the introduction of new products were more balanced than in 2013 as EUMETSAT scientists were no longer busy commissioning new satellites and could bring a first set of innovative multi-sensor and multi-satellite products to maturity.



NWC SAF

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

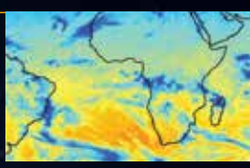


OSI SAF

Ocean and Sea Ice
Led by Météo France

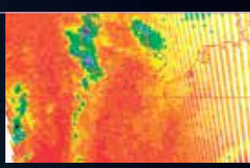
CM SAF

Climate Monitoring
Led by Deutscher Wetterdienst, Germany



NWP SAF

Numerical Weather Prediction
Led by Met Office (UK)

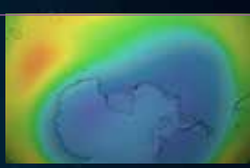


LSA SAF

Land Surface Analysis
Led by Portuguese Meteorological Institute

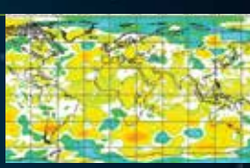
O3M SAF

Ozone and Atmospheric Chemistry Monitoring Led by Finnish Meteorological Institute



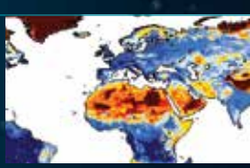
ROM SAF

Radio Occultation Meteorology
Led by Danish Meteorological Institute

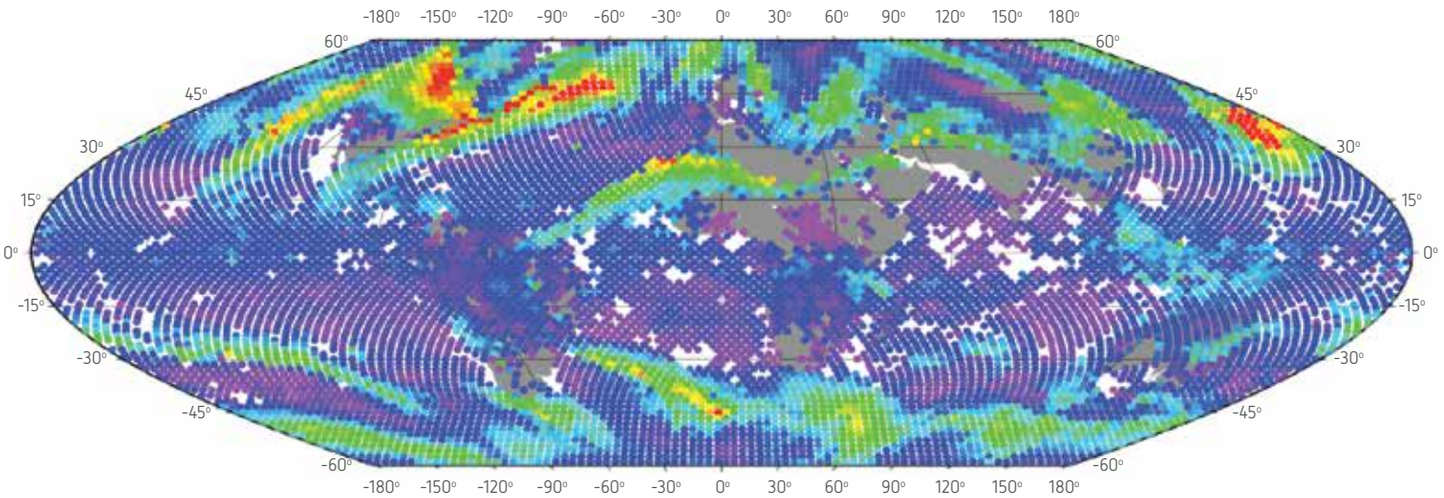


H SAF

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



DEVELOPING ENHANCED AND NEW PRODUCTS IN COOPERATION WITH MEMBER STATES AND INTERNATIONAL PARTNERS



The new global dual Metop wind product provides coverage wherever imagery from both Metop satellites overlap. The mid latitude jet stream appears in red.

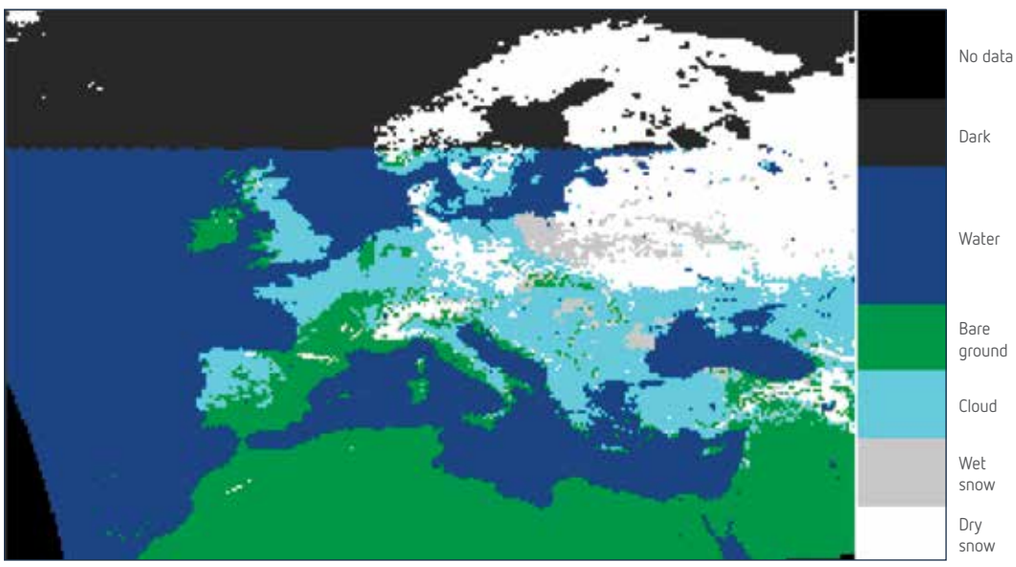
NEW PRODUCTS

METEOROLOGY

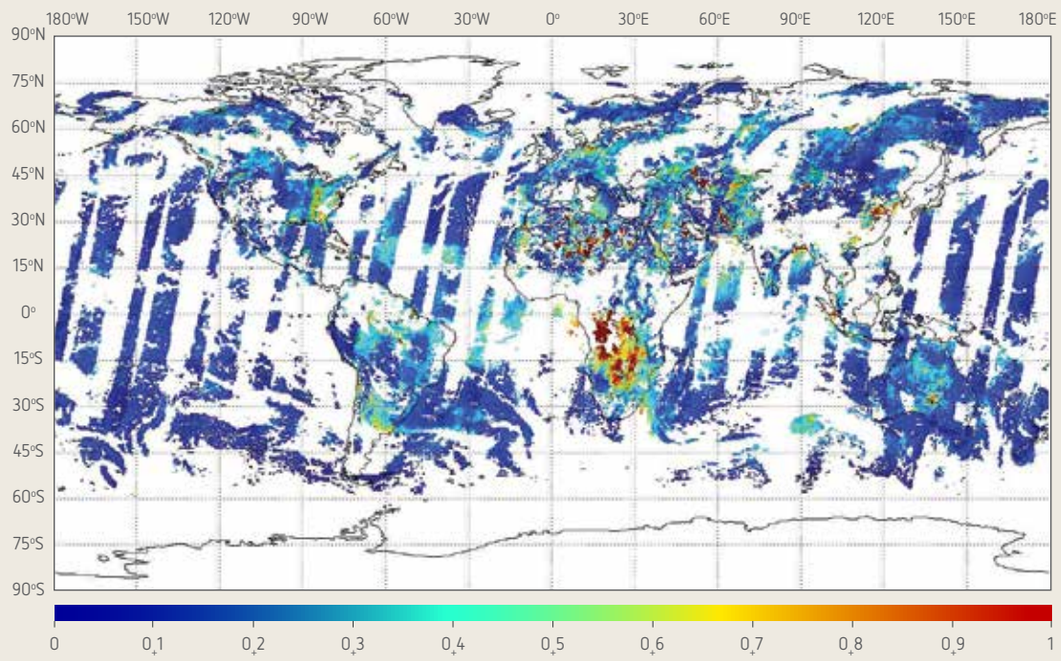
The wind vector product inferred from the displacement of clouds observed in overlapping images taken 48 minutes apart by both Metop satellites was introduced, providing global coverage for the first time. Near-real-time, high resolution vertical profiles of refractivity, temperature and specific humidity, extracted from radio occultation measurements of the Metop GRAS instruments, became available (ROM SAF). A new "Radiance Simulator" user software package was released which simulates observations by heritage sounding instruments from Numerical Weather Prediction model outputs (NWP SAF).

HYDROLOGY

A new product was introduced to qualify the state of the snow on the ground, i.e. whether it is dry or wet (H SAF), using multi-channel microwave imagery from the DMSP SSMIS sensor.



The snow status product of the H SAF (8 March 2014) indicates if the snow mantle is wet or dry. Time series provide information on thawing or freezing (source: H SAF)

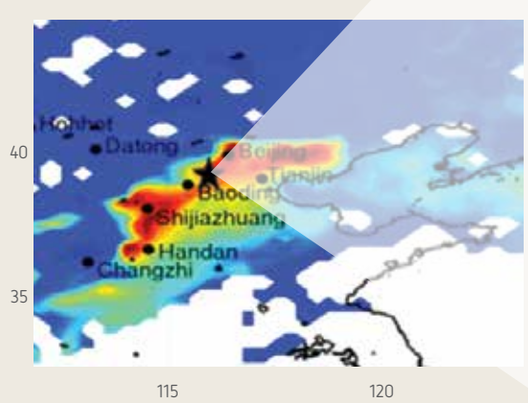


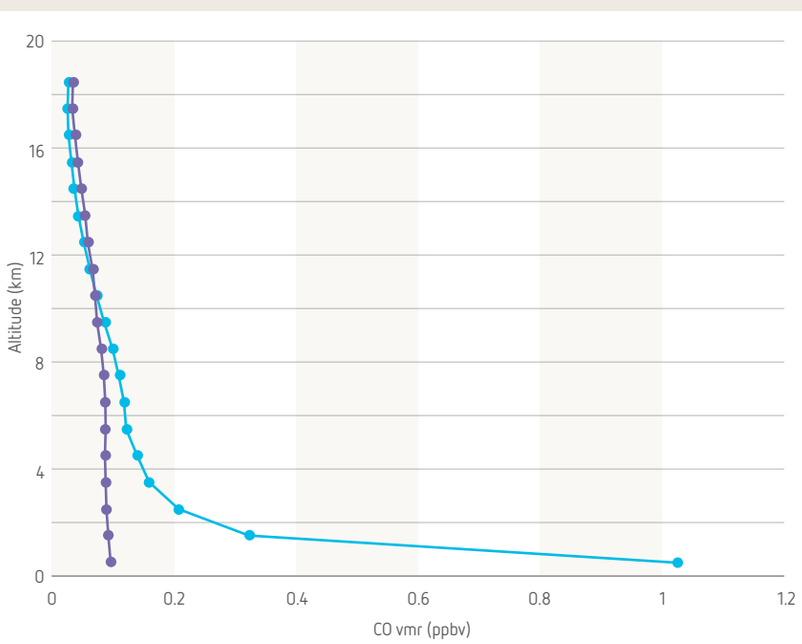
Mapping of aerosol optical depth over the ocean extracted from co-registered observations from Metop's AVHRR, GOME-2 and IASI instruments. Values over land still need validation.

ATMOSPHERIC COMPOSITION

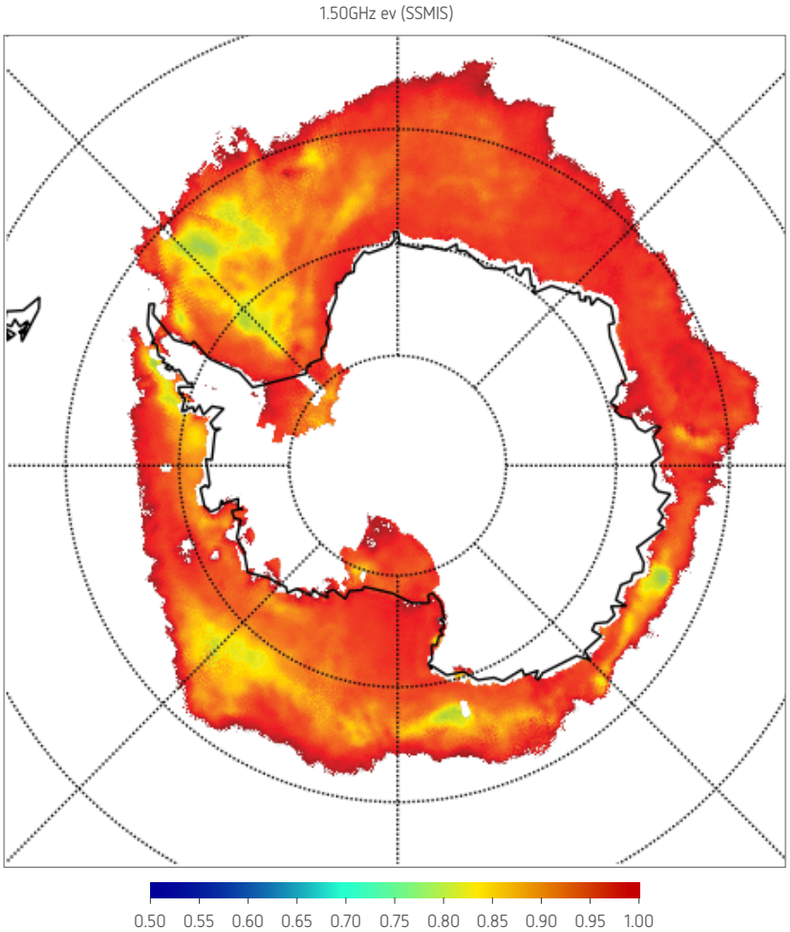
A multi-sensor product combining observations from Metop's AVHRR, GOME-2 and IASI instruments was introduced to document aerosol optical depth (operational) and type, i.e. fine mode, coarse mode/dust or volcanic ash (demonstration), along with a carbon monoxide (CO) product extracted from IASI data, providing for the first time vertical profiles in highly polluted areas, using an algorithm developed by the O3M SAF.

Total column of carbon monoxyde observed by IASI/Metop during a pollution peak in China (location marked by the star), and the corresponding vertical profile (blue) extracted using the algorithm developed by the O3M SAF/ULB/LATMOS (from Boynard et al, 2014, GRL)





DEVELOPING ENHANCED AND NEW PRODUCTS IN COOPERATION WITH MEMBER STATES AND INTERNATIONAL PARTNERS



Daily surface emissivity of sea ice at 50 GHz in the Antarctic region (source: OSI SAF)

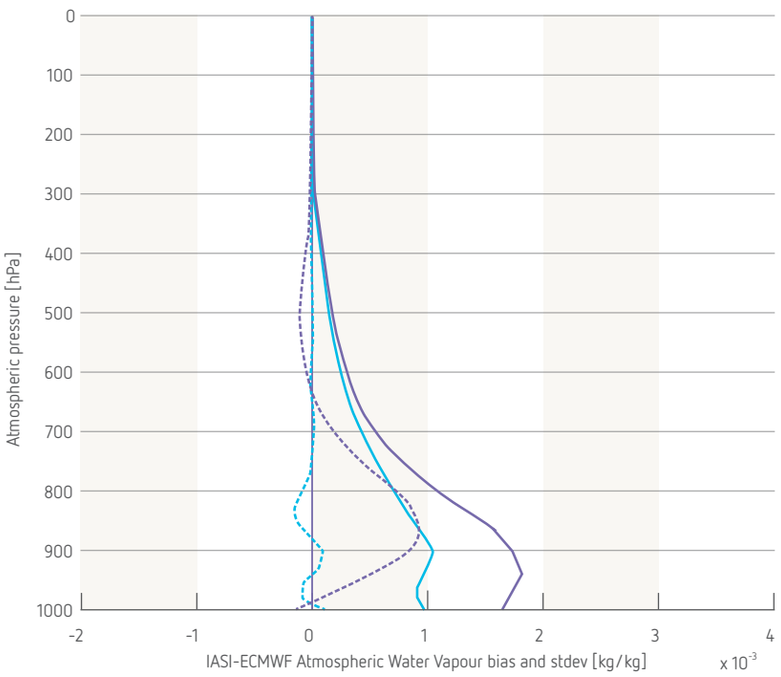
OCEAN AND SEA ICE

Daily maps of sea ice surface emissivity extracted from microwave imagery from the US DMSP satellites' SSMIS instrument (OSI SAF) became available, along with a new global sea surface temperature product extracted from IASI full resolution data, taking advantage of the excellent calibration of the instrument.

IMPROVEMENTS TO EXISTING PRODUCTS

The quality of the moisture profiles retrieved from IASI infrared spectra was significantly improved in the lower troposphere by a new multi-sensor processor using co-registered MHS/AMSU microwave soundings instead of ECMWF forecast for initialisation. The quality of the product is thus also less dependent on the ECMWF forecast. The new processor delivers full retrieval error characterisation and allows the further extraction of atmospheric composition products.

Also using a multi-sensor approach, the GOME-2 level-1 product was enhanced to include cloud fraction values derived from co-registered AVHRR imagery.



Improvements to IASI water vapour profiles: bias (dotted lines) and standard deviation (solid lines) against ECMWF model outputs are lower with new multi-sensor algorithm (blue) than with previous algorithm (purple)

Dual Metop operations improved the quality of products on high winds in the polar regions, where more frequent observations also became available through the redistribution of Suomi NPP wind products.

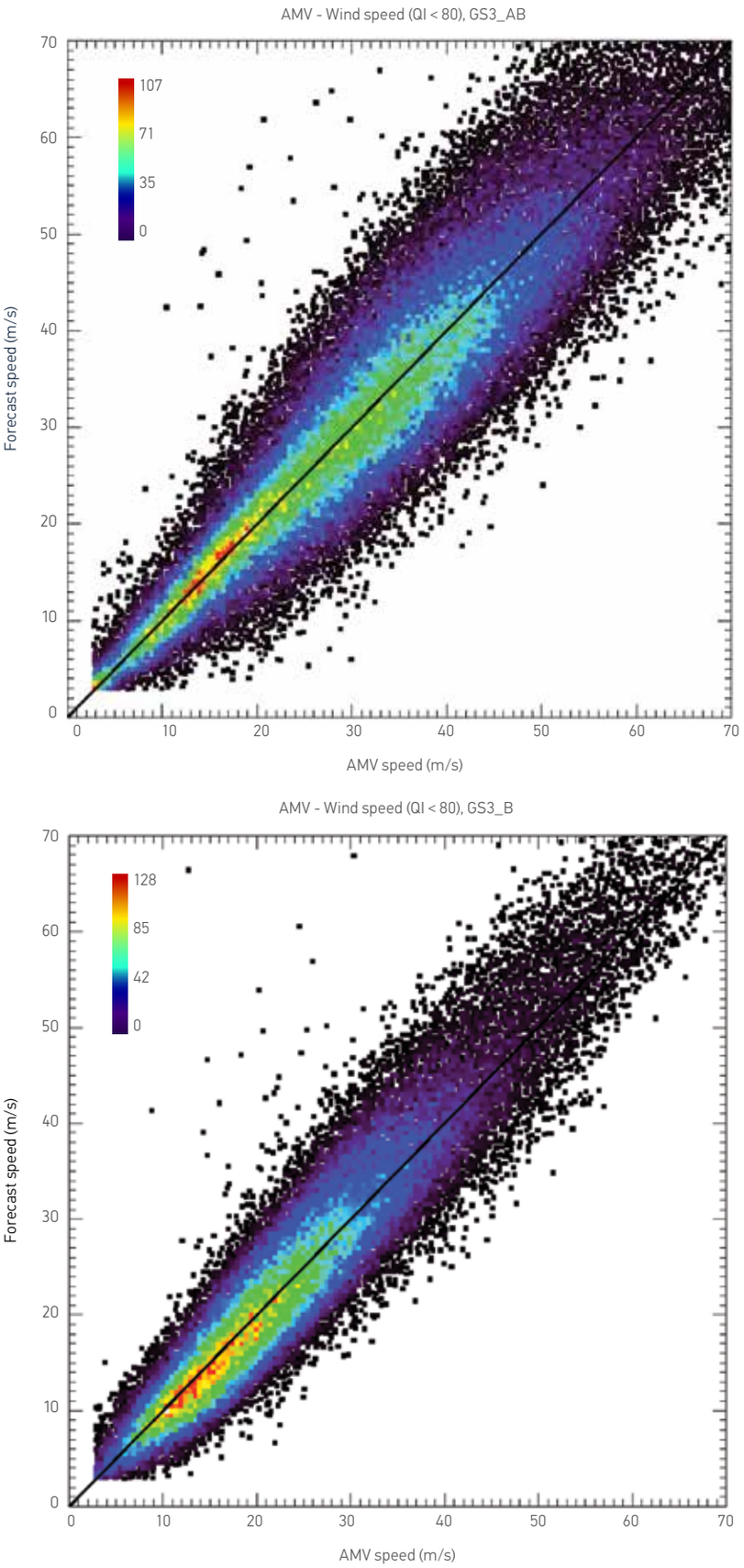
The OSI SAF introduced a medium resolution sea ice drift (Metop-A) product in addition to the existing low resolution product and enhanced some sea surface temperature and sea ice products through the selection of higher quality satellite data inputs, i.e. infrared and microwave imagery from VIIRS and SSMIS, replacing data from AVHRR and SSM/I heritage sensors.

Enhanced user software packages were also released by the SAFs on their web pages, including new versions of the PPS (Polar Platform Systems) software used for processing data from polar-orbiting satellites for nowcasting (NWC SAF), software for processing data from different types of scatterometer instruments, the RTTOV (Radiative Transfer for TOVS) radiative transfer model, AAPP (ATOVS and AVHRR Pre-processing Package) software used to extract temperature and moisture soundings across the EARS station network (NWP SAF) and the Radio Occultation Processing Package (ROM SAF). In addition, a single, integrated and user-friendly 1D-Var user software package has replaced all instrument-specific software used to retrieve soundings in the environment of a Numerical Weather Prediction model (NWP SAF).

NEW THIRD PARTY DATA SERVICES

New third party data services established in cooperation with international partners have also augmented the portfolio of real-time products delivered via EUMETCast. New meteorological products include microwave imagery of precipitation from the Chinese (CMA) FY-3 satellite series and the Japanese (JAXA) GCOM-W1 satellite and infrared and microwave soundings of temperature and moisture from the same FY-3 series and the Indo-French Megha-Tropiques mission. New marine products include ocean surface wind vectors and sea state from the China State Ocean Administration's HY-2A and a new release of the altimeter multi-mission products (DUACS) delivered by CNES.

Dual Metop operations (top) over the South Pole produce more high quality measurements of wind vector at high wind speed than Metop-B alone (bottom)



DEVELOPING ENHANCED AND NEW PRODUCTS IN COOPERATION WITH MEMBER STATES AND INTERNATIONAL PARTNERS

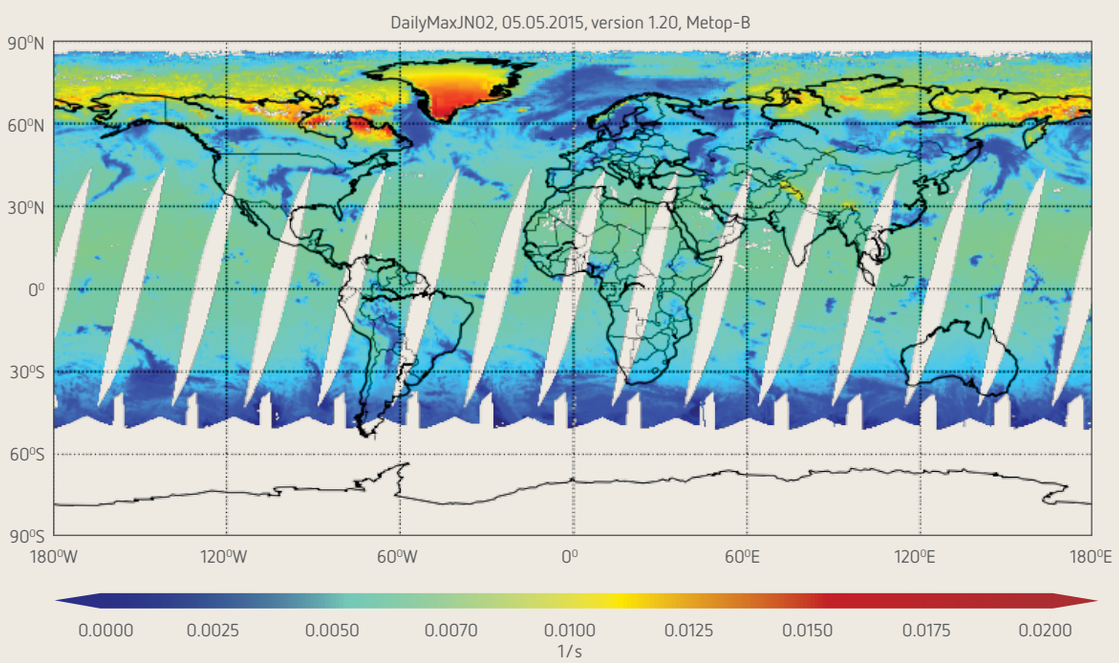
The moon observation by MSG

SCIENTIFIC DEVELOPMENTS TARGETING NEW OR ENHANCED PRODUCTS

High priority has continued to be assigned to improvements of instrument characterisation and calibration, considering their potential to enhance the quality of all downstream products. This includes attempts to reduce the biases of the on-board calibration of the Metop-B AMSU-A instrument and of Meteosat-7 infrared imagery through cross-calibration and to implement lunar calibration for the MSG visible channels. A prototype software is also under development for correcting the throughput degradation observed on the GOME-2 instruments on both Metop satellites.

A multi-sensor Aerosol Optical Depth product over land has also been prototyped, targeting demonstration in 2015. In addition, a new algorithm based on wave optics theory has been implemented to improve the accuracy of vertical bending angle profiles extracted from radio occultation measurements in the lower troposphere, and, as a result, the quality of all downstream refractivity, temperature and humidity products extracted by the ROM SAF.

The SAF network has also progressed in the development of future new and enhanced products, including land surface temperature and albedo, evapo-ranspiration, ice surface temperature, new multi-satellite precipitation products and a daily maximum NO_2 photolysis rate.



Maximum NO_2 photolysis rate extracted from GOME-2 data, describing how fast NO_2 is decomposed to NO and O radical. As the latter is an import agent for the formation of tropospheric ozone, product informs on the speed of chemical reactions increasing ozone concentration in case of NO_2 pollution episodes, like smog.

To realise the full benefit of strategic investments in advanced satellite systems, EUMETSAT continuously invests in fellowships, training, capacity building, sustained interactions with users and outreach.

"Training users is essential to realise EUMETSAT's investments. Preparing them for MTG and EPS-SG will be a priority for the next few years."

Jochen Kerkmann
Training officer
EUMETSAT

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 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 (EMI). This involves an international network of experts on satellite products, applications and techniques for using satellite data, across the network of Satellite Application Facilities (SAFs), the National Meteorological Services and the World Meteorological Organization (WMO) Virtual Laboratory (VLab).

In the first year of its new five-year training plan, EUMETSAT formalised its multi-annual contribution to the EUMeTrain cooperative project led by the Austrian Meteorological Service (ZAMG) and continued to develop e-learning and its optimised combination with "classroom" training. An online course on marine forecasting was organised with EUMeTrain and NOAA and all regional courses in Africa and the Middle East had an online component, thus giving access to more than 200 trainees who could not attend classroom training, and the online course material was used worldwide by 2,000 trainees. To further develop e-training, trainers attending the Course Development Workshop for Regional Training Institutions in WMO RA-I (Africa) were trained in online teaching.

LIST OF TRAINING AND TRAINING COORDINATION EVENTS IN 2014

FEBRUARY

Training course for weather forecasters, using a web-based simulator of the forecaster environment, *Langen, Germany*

Course on the use of EUMETSAT data for weather forecasters of Baltic countries and Poland, *Riga, Latvia*

EUMETSAT Satellite Application Course for the Middle East region (ESAC-ME-X), *Muscat, Oman*

MARCH

EUMETSAT course for weather forecasters of Western Balkan and Eastern European countries, *Darmstadt, Germany*

MAY

WMO-EUMETSAT training course on the use of satellite imagery and products for agrometeorological applications, *Ougadougou, Burkina Faso*

Nordic Meteorological Post-Graduate Education (NOMEK) training course on the use of satellite and radar data for forecasting of high impact weather, *Reykjavík, Iceland*

Training on the use of EUMETSAT data for weather forecasters of Baltic countries and Poland, 10-12 February 2014, Riga, Latvia

JUNE

International remote sensing summer school, *Bracciano, Italy*

9th EUMETCal Workshop, *Warsaw, Poland*

JULY

International remote sensing school for hydrological applications, *Rome, Italy*

EUMETSAT Satellite Application Course in English language (ESAC-XII-E), *Nairobi, Kenya*

7th WMO VLab meeting, *St Petersburg, Russia*

8th African Satellite Meteorology Training (ASMET) coordination meeting, *Darmstadt, Germany*

AUGUST

Iberoamerican training course on satellite meteorology, *Antigua, Guatemala*

SEPTEMBER

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

OCTOBER

EUMETSAT Web Training Session (Webinar) for the South America Group of EUMETCast Operators (SAGEO), *Recife, Brazil*

NOVEMBER

Course Development Workshop for Regional Training Institutions in WMO RA-I (Africa), *Casablanca, Morocco*

4th WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) training course, *Casablanca, Morocco*

EUMETSAT Satellite Application Course in French language (ESAC-XII-F), *Dakar, Senegal*

EUMeTrain online course for European marine weather forecasters

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 science base on the user side. It supports four fellowships at ECMWF and six in EUMETSAT Member States.

Four new fellows were recruited in 2014 for the research topics selected in 2013:

- 'Investigating the assimilation of geostationary water vapour radiance data to extract wind information with an Ensemble Kalman Filter' at DWD;
- 'Assimilation of hyperspectral infrared radiances using a principal component analysis in a convective permitting model' at Météo-France;
- 'Use of satellite soil moisture information for nowcasting-short range NWP forecast' at CNMCA, Italy;
- 'Developing a dynamical infrared emissivity atlas based on IASI retrievals' at Met Office (UK).

A new call was released in the autumn to select two new research topics in 2015.

EUMETSAT hosted 28 visiting scientists from China, Europe, India, Japan, South Africa and the US working on a variety of topics, including cross-calibration issues, processing and calibration/validation of data from lightning imagers and imaging polarimeters, development of new algorithms and validation of new and enhanced products.

EUMETSAT USER CONFERENCE

The EUMETSAT User Conference, co-organised with Meteo-Swiss in Geneva from 22-26 September, attracted a record number of 482 proposed abstracts and gathered 401 participants from 43 countries. A special session on socio-economic benefits of satellite observations organised by WMO at its headquarters showed that the results of a recent Meteo-Swiss study on the benefits of forecasts in the areas of transport and energy were fully consistent with those of the study commissioned by EUMETSAT on the socio-economic benefits of EPS-SG.

"As a EUMETSAT fellow at MET Norway, I develop the use of ocean surface wind measurements from space for the numerical prediction of the dangerous 'polar lows'."

Teresa Valkonen
EUMETSAT fellow
met.no

Preparations started for the 2015 conference, to be co-organised with Météo-France in Toulouse, on 21 - 25 September. The programme will include sessions on user preparedness for future geostationary systems and requirements of regional NWP for satellite data in a five-year perspective.

Left to right: Clemens Kaiser - Director of Programme Preparation and Development, EUMETSAT; Jeremiah Lengoasa - Deputy Secretary-General, WMO; Alan Ratier - Director-General, EUMETSAT; Peter Binder - Director General, Federal Office of Meteorology and Climatology, MeteoSwiss; Harry Cikanek - JPSS Programme Director, NOAA; Keiji Imoaka - Senior Researcher, Earth Observation Centre, JAXA

SUPPORTING AND EXPANDING THE USER BASE

CAPACITY BUILDING INITIATIVES

In support of the WMO strategy, EUMETSAT supports capacity building initiatives in the periphery of Europe and in Africa, which is best observed by Meteosat. This includes facilitation of data access, training of trainers and users and contributions to projects supported by WMO, National Meteorological and Hydrological Services (NMHS) of Member States, the European Union and the African Union.

In WMO Region VI (Europe), EUMETSAT hosted a training course on satellite meteorology for forecasters from NMHSs of the Western Balkans, sponsored by the WMO "Building Resilience to Disasters in Western Balkans and Turkey" programme funded by the EU Instrument for Pre-Accession, and of Eastern European and Caucasian countries.

In WMO Region II (Asia), the SADCA (SAtellite Data for Central Asia) project run in cooperation with the Turkish State Meteorological Service was successfully closed after the installation of EUMETCast stations and delivery of training in all five beneficiary countries.

"The EUMETSAT User Forum facilitates our interaction and reinforces our collaboration in furtherance of the implementation of programmes and projects related to meteorology and climate services."

H.E. Rhoda Peace Tumusiime
African Union Commissioner for Rural Economy and Agriculture

2014 was an "African year" for EUMETSAT with its 11th User Forum in Africa and the ramp-up of its support to the MESA (Monitoring Environment and Security in Africa) project and to a new initiative aimed at developing a regional Numerical Weather Prediction (NWP) capacity in Africa.

As the MESA project funded by the 10th European Development Fund entered its operational phase, EUMETSAT supported the African Union Commission (AUC) in procurements for the upgrade and maintenance of existing EUMETCast stations, the deployment of 50 more stations and user training. EUMETSAT also uploaded new software to all PUMA 2010 stations via EUMETCast to allow visualisation and processing of lightning detection, fire, marine and sounding products as well as numerical forecasts from the European Centre for Medium-range Weather Forecasts (ECMWF), Met Office (UK) and Météo-France.

In June, EUMETSAT hosted a stakeholders' workshop on the formulation of five projects aimed at strengthening the capacities of African NMHSs and Regional Centres for Disaster Risk Reduction, to be funded by the 10th European Development Fund (EDF) programme on resilience to natural hazards in sub-Saharan Africa and administered by the African Development Bank (AfDB), under an agreement signed on 30 July by the EU and the AfDB. One project led by the African Centre of Meteorological Application for Development (ACMAD) will develop a regional NWP capacity including a RARS-Africa system providing real-time access to and processing of regional data from polar-orbiting satellites for ingestion in numerical models. EUMETSAT agreed to support the procurement and deployment of the three direct acquisition L/X band stations of the RARS-Africa system.

The 11th EUMETSAT User Forum in Africa organised from 8-12 September in Benoni, South Africa, attracted around 150 participants from all over Africa, with the much appreciated attendance of the AU Commissioner for Rural Economy, who chaired one session in person. The forum endorsed the RARS-Africa project and recommended that EUMETSAT, WMO, the AUC and other partners prepare the use of MTG data in Africa and facilitate access to Copernicus Sentinel-3 marine data. The forum also endorsed the priorities proposed by the WMO RA-I Dissemination Expert Group (RAIDEG) for the dissemination of data through EUMETCast-Africa.

OUTREACH

On 24 March, on the occasion of World Meteorological Day, EUMETSAT launched a "Learning Zone" web site on meteorology and satellites to stimulate the interest of youngsters aged 12-18.

The website features a blog and is updated in cooperation with partners across the meteorological community. It was promoted via media officers of National Weather Services, the education sector, scientific institutions like the British Science Council, German media and the "Wissen ist Cool" festival in Darmstadt. On the same day, the EUMETSAT Director-General addressed more than 100 pupils from international schools at an event on "Weather and Climate: engaging youth" organised by WMO in Geneva. He stressed the socio-economic value of weather and climate information and its increasing importance for the new generations confronted with the consequences of climate change, irrespective of their professional and personal orientations, as well as the diversity of jobs related to meteorology and climate.

A new climate blog (http://climateblog.eumetsat.int/) populated with interviews with leading climate scientists attracted more than 1,000 visitors a month and was used extensively, together with social media and web streaming, to raise interest in the Climate Symposium held in Darmstadt from 13-17 October. The symposium was a key opportunity to collect additional interviews and footage to populate the blog. It attracted wide media coverage thanks to the attendance of international journalists from Nature, Nature Geosciences, Spiegel Online, Parliament Magazine and via science journalist networks. The "hyperwall" video/imagery display system deployed during the symposium by NASA was also an excellent attraction for early career scientists and for the Darmstadt school classes visiting the event.

The Learning Zone web site, launched on 24 March 2014

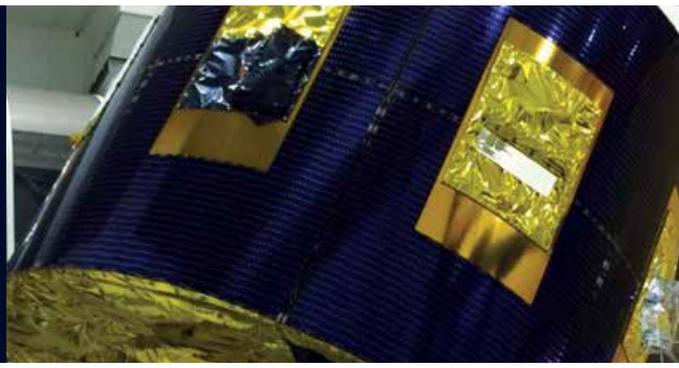
EUMETSAT increased its cooperation with the City of Darmstadt to promote its profile through participation in the "Darmstadt Marketing" programme, organising in particular monthly tours of its facilities for external visitors. EUMETSAT also hosted the Darmstadt Business Partner event for the first time, providing attendees the opportunity to get to know EUMETSAT first hand.

The €3,350 collected at the 2014 Christmas party were donated to the Frauenhaus Bergstrasse Association, a charity which offers shelter to women and children of all nationalities threatened by physical or psychological abuse. EUMETSAT's donation will be spent to support training, schooling and initiatives to help children deal with traumatic situations.

On behalf of EUMETSAT employees, the Director-General and François Montagner, Chairman of the EUMETSAT Staff Association Committee, present a cheque to Christine Klein, President of the Frauenhaus Bergstrasse Association

OPTIMUM DEPLOYMENT OF RECURRENT SATELLITES

MSG-4 and Metop-C, the last satellites of the current generation, will build the crucial bridge to the new MTG and EPS-SG systems. MSG-4 was fully tested and put on track for launch in July 2015, while the launch date of Metop-C was postponed from February to October 2018 after reassessment of risks.

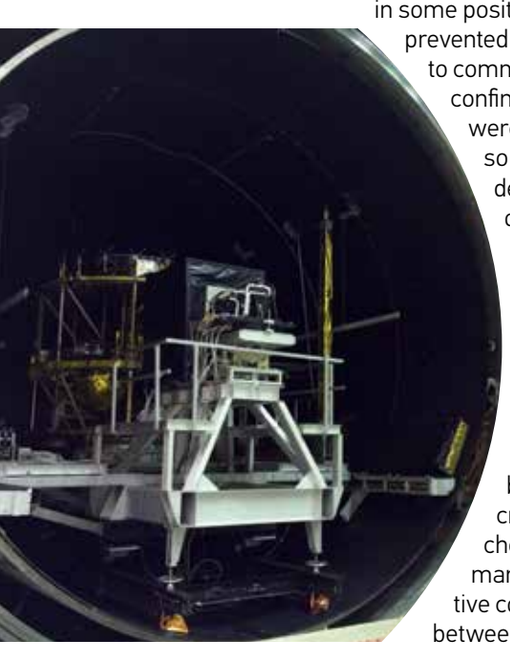


MSG-4 READY FOR LAUNCH IN SUMMER 2015

The refurbishment of the SEVIRI imaging instrument's calibration unit was completed by Airbus Defence & Space in early January, after procurement, testing and qualification of a new type of motor magnets. This concluded the recovery of the anomaly discovered in 2013 and the instrument could be returned to the prime contractor on 4 February for integration and electrical testing on the satellite.

In the meantime, the GERB-4 instrument had to be dismounted from the satellite and shipped back to Rutherford Appleton Laboratory (RAL) to explore design changes that could mitigate the risk of blockage of the de-spin mirror encountered during satellite tests and in orbit on GERB-3. Tests performed on the GERB development model pointed to very low torque in some positions of the mirror, which prevented the instrument from responding to commands. Corrective design changes confined to the instrument electronics were implemented over the summer, so the GERB-4 instrument could be delivered to the prime contractor on 15 September for reintegration on the satellite.

MSG-4 in the test chamber

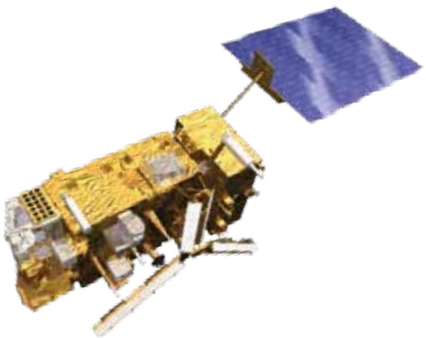


During the summer, the satellite passed its most critical tests needed for launch readiness. After the acoustic vibration tests showed no major differences with the test performed in 2006 before satellite storage, the critical optical vacuum test checked the end-to-end performance of the satellite in representative conditions of in-orbit operations between 15-25 July and confirmed that SEVIRI performance was well within specifications. After reintegration of the GERB-4 instrument, the satellite test programme was brought to a successful close in November, confirming its readiness for launch in July 2015.

In parallel, the configuration of a ground segment capable of supporting the launch of MSG-4 and operations of four satellites in orbit was confirmed on 3 September. This includes the new virtualised data processing chain, legacy control centre and four main antennas, including the upgraded antenna in Fucino and the repaired antenna in Usingen. Both antennas were then declared operational on 28 October and the virtualised data processing chain was rolled out on 4 November. A series of smooth Operations System Validation Tests rehearsed commissioning, in-orbit storage, routine operations of four spacecraft as well as in orbit mission swap between MSG satellites.

It was determined that the optimum configuration of the satellite during in-orbit storage would be to switch all payloads off but have the SEVIRI focal plane thermally controlled. The SEVIRI and GERB instruments will be fully activated twice a year for maintenance purpose.

With the achievement of this level of readiness, interactions with Arianespace focused on the identification of suitable co-passengers for dual launch on Ariane-5, concluding that the safest option was a targeted dual launch in the June-July 2015 timeframe. The feasibility of this was confirmed with ESOC, the LEOP service provider, after a detailed assessment of the compatibility of launch windows with co-passengers. After final negotiations with Arianespace, a 16 June-15 July 2015 launch slot was agreed and the target launch date was set for 2 July.



METOP-C LAUNCH RE-PLANNED FROM FEBRUARY TO OCTOBER 2018

Preparations for the launch of Metop-C in 2018 focused on risk management and reassessment, addressing the reworking of instruments that are subject to anomalies or modification, the change of the launch site from Baikonur to Kourou, and the capacity of the ground system to support operations of three Metop satellites in orbit.

Following investigations of two anomalies on the IASI infrared sounder, it was decided to rebuild the scan mechanism and refurbish both corner cube subsystems of the mission-critical interferometer. The repair plan established with CNES was kicked off in July and inspection of the dismounted scan mechanism confirmed that a rebuild was the right decision.

A comprehensive risk analysis involving scientists, engineers and industry was conducted to determine whether the GRAS instrument should be modified to cope with the possible phasing out of one GPS frequency (code P(Y)) by the US authorities in 2021. ECMWF found the impact of instrument performance degradation simulated by EUMETSAT on Numerical Weather Prediction performance to be insignificant, even in the worst case. On that basis, the Council followed the recommendation to fly the GRAS instrument “as is” on Metop-C, thus saving M€ 12.

The nominal Q-Band Source as well as the down converters for two channels of the Microwave Humidity Sounder had been found to be out of performance specifications. In order to achieve the required performance, they were replaced by spare units.

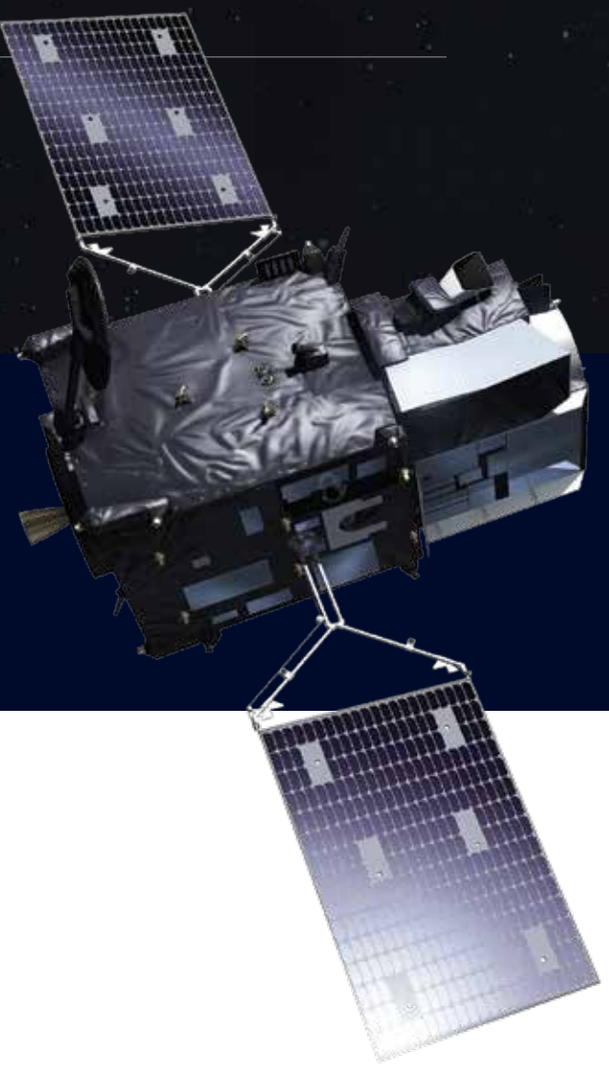
The Preliminary Mission Analysis Review for the Metop-C launch service held in February by Arianespace, raised a couple of critical issues in relation to the changes from Baikonur to Kourou, mainly related to the reduced launcher performance from Kourou due to safety constraints and the implementation of a new launcher interface adapter. Arianespace proposed a different configuration of the Soyuz launcher to deliver Metop-C to orbit featuring a Fregat-M upper stage similar to the one used for Metop-B instead of the contractually foreseen Fregat-MT. The delta Preliminary Mission Analysis Review confirmed the adequacy of this solution on 12 November. In addition, an assessment of the implications of the failed Soyuz launch of the Galileo satellites from Kourou (on 22 August) was conducted. The conclusion was that the cause of the launch failure (freezing of hydrazine feeding the Fregat third stage) was a design limitation of the Fregat propulsion system which would be eliminated long before the launch of Metop-C.

The capacity of the EPS ground segment to handle three Metop satellites (Metop-A, -B and -C) was validated by testing, but the hardware of the data dissemination server needs to be upgraded to support the heavy load of three data streams.

In light of a full reassessment of the schedule, constraints and risks at the satellite, system and programme levels, and considering the outcome of the Metop Lifetime Review, the target launch date was postponed from February to October 2018, and the negotiations on the contract change required to realign industrial activities with the new date were concluded with Metop-C industry.

NEW MANDATORY PROGRAMMES

The MTG programme entered its detailed design phase, with most of the major contracts placed or subject to ongoing procurements, and the approval process for the EPS-SG programme started.



METEOSAT THIRD GENERATION (MTG)

Approved in 2011, the Meteosat Third Generation (MTG) programme will continue into the 2020-2040 timeframe and expand 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.

MTG will be the most complex and innovative operational geostationary system ever built, comprising two separate lines of satellites exploited simultaneously. The MTG-I (imaging) line will significantly improve the Meteosat imagery mission and add a lightning imaging capability, while the MTG-S (sounding) line will establish a world premiere hyperspectral infrared sounding capability in geostationary orbit that delivers 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.

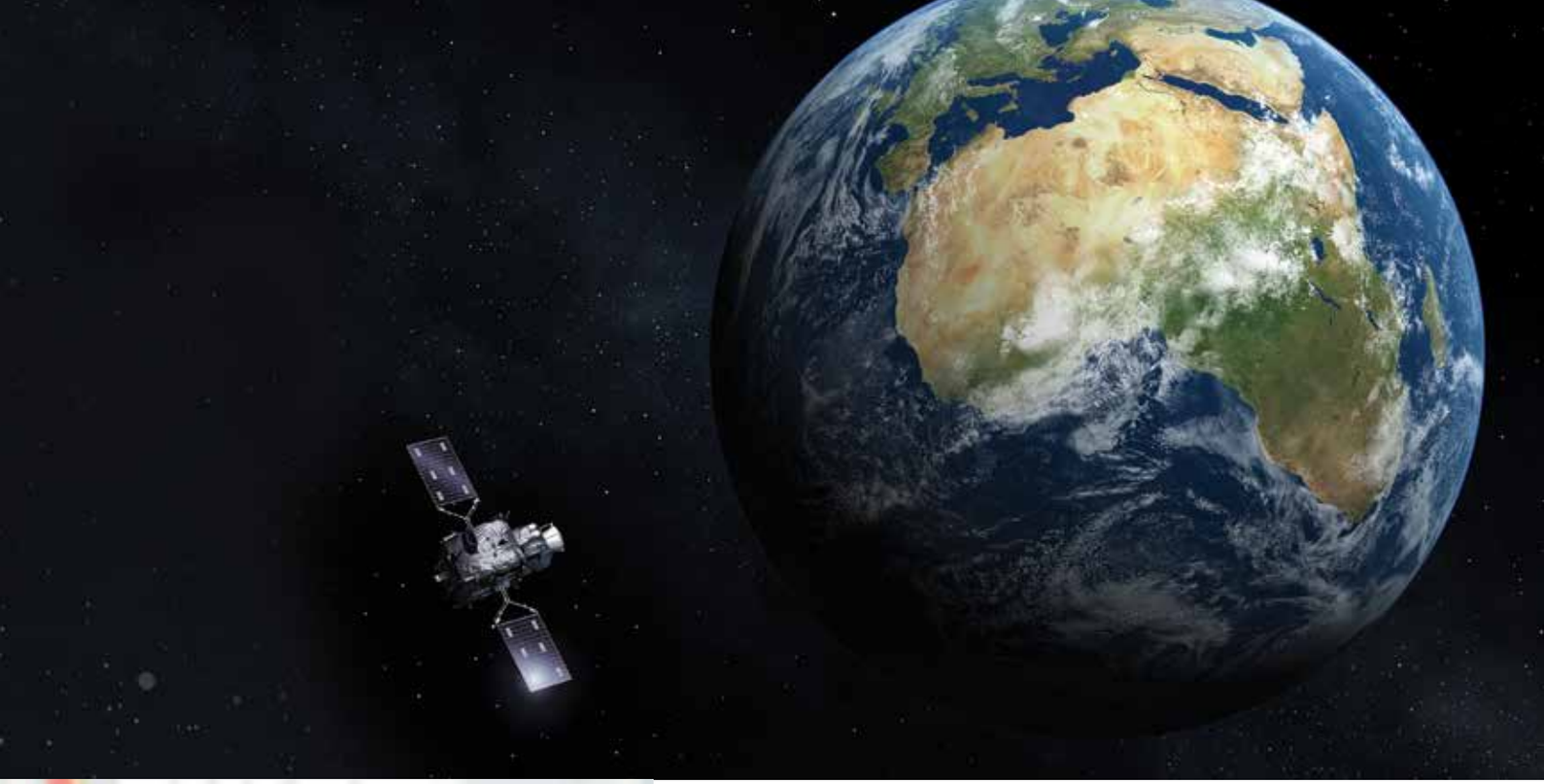
In 2014, EUMETSAT supported ESA in the negotiations to convert the industrial space segment contract to a fixed price, focusing on the implications for the recurrent satellites fully funded by EUMETSAT. The final deal was considered acceptable, as the additional cost to EUMETSAT was contained within the limit of liability agreed with ESA and partially offset by future savings on storage/destorage of the satellites and launch campaigns.

The satellite development schedule remained relatively stable, compatible with the launch dates assumed in EUMETSAT's planning, i.e. MTG-I-1 in early 2019 and MTG-S-1 in mid-2021, although intermediate milestones, in particular the critical design reviews and qualification reviews of instruments and the platform have slipped by a few months.

The Flexible Combined Imager (FCI) is on the critical path of MTG-I development in view of remaining challenges for the development of the scan assembly. The Lightning Imager is close behind due to an estimated 3.5-month schedule penalty imposed by the introduction of a buffer needed to avoid propagation of micro-vibrations into the instrument that could create false alarms in lightning detection.

For the MTG-S satellite, the Infrared Sounder (IRS) instrument is on the critical path, but the design modifications of its cryo-cooler heat transfer loop are now grounds for confidence that a detector temperature of 55 K can be achieved as required to meet radiometric performance requirements.

EUMETSAT maintained close scrutiny of the performance of both the MTG-I and MTG-S satellites and the compatibility of their mass and volume with the planned launcher. The mass reduction plan agreed with ESA could contain the mass within the 3.6-3.8 tonne range, which, together with the shortening



"All EUMETSAT engineers and scientists developing the MTG and EPS SG systems are proud to prepare the future of meteorology in Europe."

Clemens Kaiser
Director of Programme Preparation and Development
EUMETSAT

of the FCI and IRS instrument baffles, secured compatibility of both satellites for an Ariane-5 dual launch in lower position. This allowed EUMETSAT to release the request for quotation for the three initial launch services to Arianespace in June.

After the formal close-out of the system Preliminary Design Review, on 12 February, EUMETSAT system development activities reached important milestones in June, with the release of the ITT for the initial Launch and Early Operations Phase (LEOP) services and the successful software requirement review for the satellite simulator developed by the satellite contractor. The software requirement review concluded that the simulator would be ready in time to start testing the mission control ground segment facility during the first system validation tests in early 2016.

Ground segment development activities moved from system level design to procurements and development of subsystems ("facilities"). The five facilities required to support the MTG-I mission are now under contract or subject to an open ITT.

The preliminary design review (PDR) of the Mission Operations Facility (MOF) was closed out in October, after consolidation of requirements traceability, verification and validation plans. The MOF will control the satellites and the mission through the MTG ground stations, the so-called Mission Data Acquisition Facility and Telemetry Tracking and Control Facility. The contracts for both stations were kicked off on 23 September and 25 November, respectively.

The PDR of the instrument data processing chain for the MTG-I imagery mission (IDPF-I) was closed out in November. After an independent review by the EUMETSAT instrument functional chain teams, the initial definition of algorithms was discussed with the contractor at a first formal algorithm panel, backed by geometric test data and instrument data processing simulations produced by EUMETSAT. The next milestone in the development of the IDPF-I will be the critical design review of the processing infrastructure hosting the processing software and managing production.

In preparation of the procurement of the instrument data processing chain for the sounding mission (IDPF-S), a simulator of the detection chain of the IRS sounder was developed to support the assessment of instrument data processing algorithms and the generation of test data.

The ITT for the Level 2 Processing Facility extracting a subset of the meteorological products from instrument data products was published in April, after a review of the candidate algorithms for the extraction of infrared sounding products.

In parallel, MTG Requirements Reviews were concluded for the four Satellite Application Facilities responsible for developing the other MTG products. Proxy data simulating measurements of the MTG instruments were generated to support prototyping of product extraction algorithms and user preparedness.

The next EUMETSAT system development milestone will be the System Implementation Review planned towards the end of 2015 as an intermediate step towards the system CDR planned in 2017. It will review the status of implementation of the system required to support the MTG-I mission and the plans for MTG-S.

EUMETSAT POLAR SYSTEM SECOND GENERATION (EPS-SG)

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.

The challenge of 2014 was the timely consolidation of all system and ground segment requirements and architectural design. This was imperative to deliver a solid EPS-SG programme proposal and the legal instruments required for its approval by Member States.

The system requirements review validated the requirements for the design and development of the full system in April, followed in July by the Overall Ground Segment Requirements Review addressing the architectural design of the ground segment and its procurement approach. The procurement is split in two loosely coupled facilities - the Mission Control and Operations and the Payload Data Acquisition and Processing

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) AVHRR (NOAA)	■ ■ ■
VISIBLE-INFRARED IMAGING (VII)	METIMAGE (DLR)		■ ■ ■ ■ ■ ■
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)	NONE	■ ■ ■ ■
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)	NONE	■ ■ ■ ■ ■
ICE CLOUD IMAGER (ICI)	ICI (ESA)	NONE	■ ■ ■ ■
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

facilities - each forming one full functional chain that can be tested in full by Industry. In addition to optimising ground segment and system level testing, the approach minimises complexity and risks of the integration work to be performed by EUMETSAT.

The EPS-SG Programme Proposal also required inputs from the ESA space segment development programme, in particular as regards the cost of the recurring Metop-SG satellites fully funded by EUMETSAT. These inputs became available after the selection of Airbus Defence & Space (France and Germany) as prime contractors for both Metop-SG satellites by ESA and the conclusion of the negotiations on both contracts by ESA and EUMETSAT.

The finalisation of all draft cooperation agreements was also achieved ahead of the July Council session, following agreement with the German Aerospace Center (DLR) on the financial aspects of the cooperation on the development of the METImage instruments and clearance by the US Department of State of the draft Joint Polar System (JPS) Agreement with NOAA covering the sharing of ground station services (Svalbard and McMurdo).

The above work enabled the finalisation of the draft proposal for an EPS-SG programme including three successive pairs of Metop-SG A and Metop-SG B satellites, covering 21 years of operations at a lower annualised cost than EPS. The launch of the first pair of satellites is planned in 2021/2022. The total programme cost was reduced by 4.7% with respect to previous estimates, taking into account programme optimisation and descoping agreed by Council.

After the 80th Council froze the text of the programme proposal and established the legal instruments for its approval by Member States on 1 July, the process was formally opened on 10 September, when unanimity was reached on the voting of all texts. At the end of 2014, noting that 87.55% of the financial envelope was already covered by commitments from 24 Member States, the 81st Council agreed to authorise the start of activities as soon as commitments reach 95% in anticipation of the unanimous approval of the programme.

In the meantime, technical work continued under the EPS-SG Preparatory Programme, including support of the development of the Metop-SG satellites by ESA and the IASI-NG and MetImage instruments by CNES and DLR.

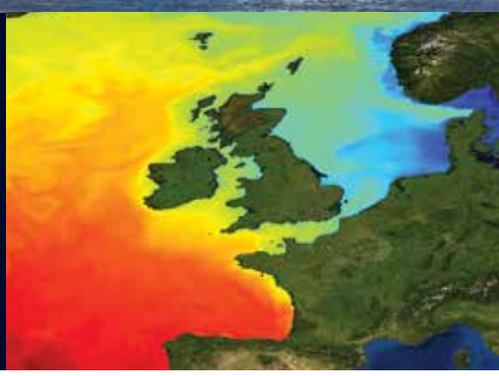
System and ground segment work focused on the preparation of the Preliminary Design Reviews and the delivery of the main ground segment procurement proposals planned in 2015.

EUMETSAT supported the ESA System Requirements Review (SRR) for the Metop-SG satellites, which was successfully concluded on 24 October, firming up the satellite requirements baseline for the preliminary design.

EUMETSAT also supported the IASI-NG SRR organised by CNES and successfully closed in October as well as the delta system requirements review for the redesigned METImage instrument organised by DLR and closed in January 2015. The Preliminary Design Reviews of both instruments were planned for the first quarter of 2015.

OPERATIONAL OCEANOGRAPHY

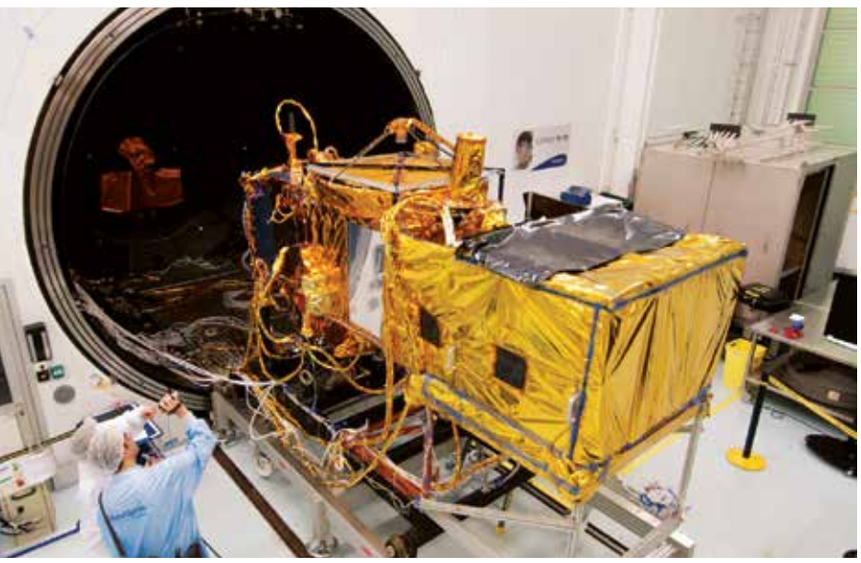
Cooperative test programmes have paved the way for the launches of Jason-3 and Sentinel-3A in 2015, while the optional Jason-CS programme was opened for subscription as EUMETSAT's contribution to the Sentinel-6 mission. With these missions, EUMETSAT will deliver the integrated marine data service required for the development of operational oceanography in Europe.



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, surface wind, sea level, surface temperature, ocean colour, sea ice, incoming solar radiation and precipitation over the ocean with equally indispensable in situ observations from ships, buoys and profiling floats (ARGO) and with ocean models has heralded the era of operational oceanography.

EUMETSAT is involved in the development of two cooperative ocean missions, Jason-3 and Sentinel-3, both scheduled for launch in 2015, and is preparing to exploit both systems on behalf of the European Union, under its tasks entrusted by Copernicus. EUMETSAT is also a partner in the design of the Jason-CS/Sentinel-6 mission foreseen to continue Jason-3 observations.

Jason-3 in the test chamber



JASON-3 READY FOR LAUNCH IN SUMMER 2015

Replacing the ageing Jason-2 satellite, Jason-3 will expand until 2020 the unique mean sea level climate data record initiated in 1992 by Topex-Poseidon and continue to provide the reference ocean surface topography measurements used for cross-calibrating all other altimeter missions, including Sentinel-3.

The successful tests of the Jason-3 satellite and ground segment performed by CNES, NASA, EUMETSAT and NOAA paved the way for the launch planned in 2015.

After the satellite passed all tests, including the most critical thermal vacuum test in July, the Flight Acceptance Review was declared successful in December and Jason-3 entered into storage.

The operational qualification tests of the cooperative ground segment were completed in parallel, supporting the last system validation test (SVT 3) involving command of the spacecraft.

After all components of the system had been tested, the Operational Readiness Review of the full system could then start on 16 December. It was scheduled to be concluded in February 2015 with the decision to proceed with the preparation of the launch campaign after the NOAA announcement of the new target launch date.

A CHALLENGING TEST PROGRAMME FOR SENTINEL-3

The Sentinel-3 marine mission will provide complementary altimeter measurements to those of Jason-3 and 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.

As part of its contribution to the ESA development programme, EUMETSAT concluded the formal integration, verification and validation tests of the Sentinel-3 mission control centre - called the Flight Operations Segment (FOS) – installed at its premises in December, with the acceptance review.

The FOS was used to exercise the full satellite command chain during the second satellite validation test successfully performed by ESA.

The upgraded EUMETSAT multi-mission data dissemination and archiving systems were then integrated into the Sentinel-3 ground segment and their verification and validation testing commenced.

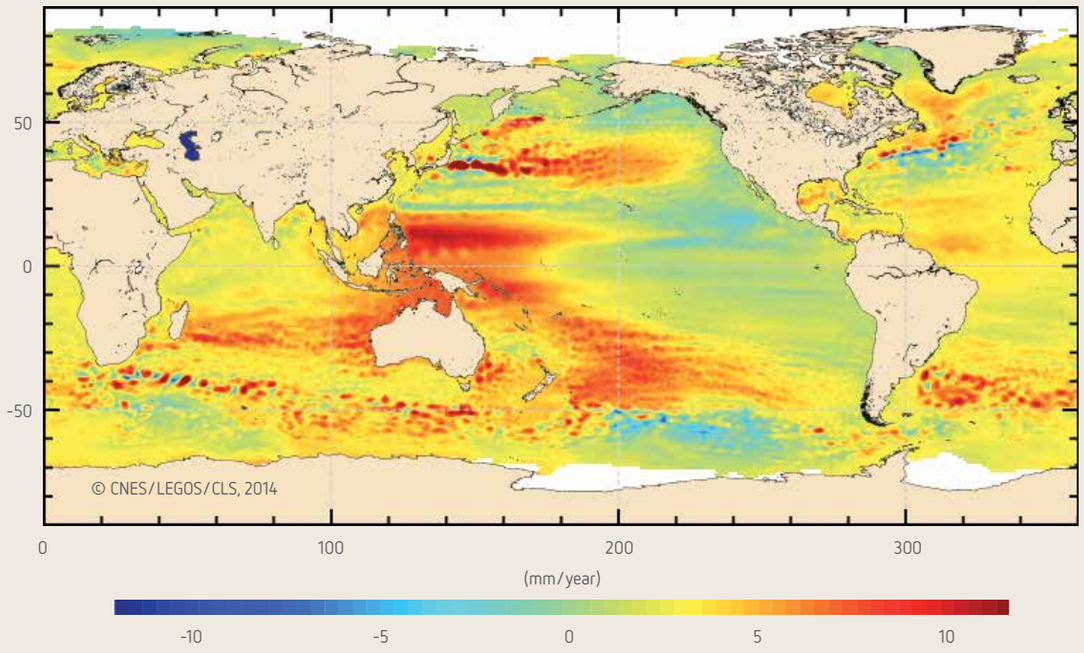
The hardware platform of the payload data generation segment (PDGS) supporting end-to-end Sentinel-3 data processing was also integrated but PDGS testing had to be delayed pending the delivery of the version of the software required to support launch and commissioning of Sentinel-3A. The full on-site verification and validation test programme of the PDGS was foreseen for spring 2015, followed in July by the testing of a final software patch fixing all launch-critical anomalies.

Testing of Sentinel-3 operations, EUMETSAT Copernicus Mission Control, Darmstadt, Germany

This is a tight schedule towards the launch of Sentinel-3A, now scheduled in October 2015, but the ESA, EUMETSAT and industry teams are striving to meet that challenge in the best cooperative spirit.

As part of its Copernicus activities entrusted by the EU, EUMETSAT released the ITT for the ramp-up of the Sentinel-3 operations team, after presentation at an industry day hosted at its headquarters. Five companies were selected under the framework contract for restricted competition on forthcoming work orders scheduled to be released in 2015, when commitment appropriations become available from the EU budget. EUMETSAT staff were recruited in parallel to manage Sentinel-3 operations and provide engineering and science support, and will all be in post in May 2015.

After the signature of the respective Copernicus agreements with the EU, discussions restarted with ESA on the joint management of Sentinel-3 commissioning and operations, including the handover of the PDGS to EUMETSAT.



Map of regional trends (1993 - 2014) of mean sea level extracted from Topex/Poseidon and Jason altimetry data (source: CNES/LEGOS/CLS)

EUMETSAT'S CONTRIBUTION TO THE SENTINEL-6 MISSION TAKES SHAPE

The Jason-Continuity of Service (Jason-CS) optional programme is EUMETSAT's contribution to the development and implementation of the Copernicus Sentinel-6 mission. The mission will continue the high accuracy ocean surface topography measurements after Jason-3, from 2021 to 2032. A constellation of one Jason satellite and two Sentinel-3 satellites will thus be maintained in orbit in the period 2015-2032, as the European backbone of an international space-based ocean observing system.

Building on the heritage of previous Jason cooperation, the Sentinel-6 mission involves Europe, through EUMETSAT, ESA and the European Union (EU), and the United States (US), through NOAA and NASA. The mission will be funded through a combination of the ESA GMES Space Component Programme, the EUMETSAT Jason-CS optional programme, the EU Copernicus Programme and a US Jason-CS Programme. The EUMETSAT programme will provide a fixed financial contribution to the ESA satellite development programme and fund European instruments of the second satellite, otherwise funded by the EU.

Under the agreed sharing of responsibilities, EUMETSAT leads system activities, develops the ground segment and exploits the European part of the system on behalf of Copernicus.

In 2014, EUMETSAT reviewed the system and ground segment requirements and architecture and reassessed ground segment costs.

Part 1 of the System Requirement Review, involving all partners, confirmed the validity of user, mission and system requirements, their consistency with satellite requirements, and the adequacy of the operations concept. A EUMETSAT task force then assessed the design, architecture and cost drivers of the ground segment and proposed to minimise development risks and costs through the reuse of existing assets and an optimum procurement approach for the remaining elements.

In parallel, ESA concluded the satellite Preliminary Design Review and negotiated the development contract with industry, in view of its signature in the first quarter of 2015.

The cooperative work of all partners provided all technical and financial inputs to the EUMETSAT Jason-CS programme proposal. After its endorsement by the 15 EUMETSAT Potential Participating States, the Council opened the programme for subscription on 26 November, and France was the first country to subscribe on that day.

Ahead of the 21st Conference of the Parties to the UN Framework Convention on Climate Change, to be held in Paris in 2015, the programme received formal support from the IPCC Chairman and the Small Island Developing States threatened by sea level rise.

COOPERATION WITH OTHER SATELLITE OPERATORS

Through cooperation with other operators, EUMETSAT delivers its data to a broader user community and gains access to additional data, for the benefit of Member States of EUMETSAT and the World Meteorological Organization.

BILATERAL COOPERATION

NOAA announced that the Suomi NPP satellite has become the prime US satellite in the Initial Joint Polar System (IJPS) and that the Antarctic Data Acquisition (ADA) service has gained operational status, acquiring all Metop-B passes except when the McMurdo station supports the launch of a US satellite. Both parties welcomed the signature of an agreement on space situational awareness between EUMETSAT and the US Department of Defense to protect their shared IJPS assets against space debris.

NOAA and EUMETSAT finalised their draft Joint Polar System (JPS) Cooperation Agreement whereby they agree mutually beneficial cross-support arrangements for their future Metop-SG and JPSS satellites, involving the shared use of the services of the Svalbard and McMurdo stations. The agreement will be signed in 2015, when the EPS-SG Programme has entered into force.

Uncertainties on the planning of the Jason-3 launch dissipated on 13 December, when the US Congress approved fiscal year 2015 funding for the NOAA-provided launch service. NOAA was scheduled to announce the new target launch date in early 2015.

EUMETSAT and NOAA have agreed to reinforce cooperation on their innovative GOES-R and MTG-I geostationary lightning imagery missions, in view of the design similarities of the instruments and the future synergy of their observations over the Atlantic Ocean. Algorithms, data processing, calibration and validation were scheduled to be discussed in spring 2015 at a joint workshop in Rome.

EUMETSAT and NOAA also agreed to jointly plan the transition from the current Meteosat data broadcast service to Americas (EUMETCast-Americas) to the future NOAA GOES Rebroadcast Service.

In cooperation with NASA, EUMETSAT has prepared the redistribution of real-time precipitation products from the Global Precipitation Mission (GPM) Core Observatory mission and ocean surface wind products from the Rapidscat instrument deployed on the International Space Station.

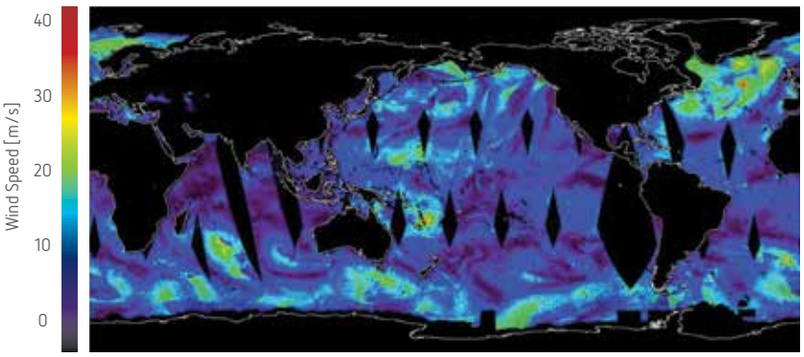
NOAA and NASA have continued to support EUMETSAT and ESA in the preparatory work for the follow-on Sentinel-6 mission and both agencies provided highly appreciated support to the Climate Symposium organised by EUMETSAT and the World Climate Research Programme (WCRP).

Following the appointment of Dr Stephen Volz as the new Deputy Assistant Administrator for NOAA NESDIS, the full scope of bilateral cooperation was reviewed at a bilateral meeting in Washington, in December.

Further cooperation opportunities with the China Meteorological Administration (CMA) were discussed at a joint scientific and technical workshop and endorsed by the EUMETSAT Director-General and the CMA Administrator during his first visit to EUMETSAT, on 16 June. This includes exchange and redistribution of data from new instruments from polar-orbiting satellites and the integration of FY-3 data into the EUMETSAT EARS regional data services, to supplement Metop and Suomi NPP data. EUMETSAT hosted two CMA visiting scientists for four to five months to support joint work on cross-calibration of geostationary satellite instruments.

COOPERATION WITH OTHER SATELLITE OPERATORS

Participants in the 42nd plenary session of CGMS in Guangzhou, China



Ocean surface wind vector products available to EUMETSAT Member States since December from the Chinese State Ocean Administration's HY-2A satellite

The cooperation with the China State Oceanic Administration (SOA) produced its first benefits for EUMETSAT users in December, when ocean surface wind vector and sea state products from the HY-2A satellite started to be disseminated via EUMETCast.

The new agreement with the Indian Space Research Organisation (ISRO) on "Cooperation in exchange, redistribution and utilisation of data and products from meteorological and ocean satellites in support of weather analysis and forecasting and other related areas" entered into force on 20 January. Capitalising on the highly successful Oceansat-2 data services, the cooperation will focus on follow-on services using data from the future Scatsat-1 and Oceansat-3 satellites and processing of radio occultation observations from instruments flown on ISRO satellites.

Following the agreement reached with the Japan Aerospace Exploration Agency (JAXA) in 2013, EUMETSAT continued to redistribute precipitation products from the GCOM-W1 mission to the NMSs of its Member States and to ECMWF and provided positive user feedback to its Japanese partner.

The agreement with ROSHYDROMET extending the cooperation on exchange of data and products from meteorological satellites for another five years was approved by EUMETSAT and the Russian authorities for signature in 2015. In the meantime, scientific and technical cooperation focused on the preparation of a training course planned in 2015 in Moscow and on joint contributions to the EARS regional data services, for which new hardware and software was installed at the Moscow station.

MULTILATERAL COOPERATION (CGMS)

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

In May, the 42nd CGMS Plenary meeting, hosted in Guangzhou by CMA and the Chinese National Space Administration (CNSA), welcomed ISRO's intention to join CGMS, in view of its increasing contribution to the WMO Integrated Global Observation System (WIGOS) and discussed how to continue the Indian Ocean Data Coverage mission after the deorbiting of Meteosat-7, based on the assets of multiple partners. On that basis, and further encouraged by the WMO Executive Council, ISRO, CMA, Roshydromet and EUMETSAT assessed possible scenarios against the Meteosat-7 benchmark, considering INSAT-3D as a core asset in view of the very positive quality assessment of its imagery, but also extended operations of back- up FY-2 and Meteosat satellites over the Indian Ocean and using Electro L for the data collection mission.

CGMS also encouraged CMA to further consider launching one FY-3 polar-orbiting satellite on the unpopulated early morning orbit as a historical opportunity to realise the WMO Vision 2025 of WIGOS already in 2017.

The signature of the agreement with the EU established EUMETSAT as the operator of the Copernicus Sentinel-3, -4, -5 and -6 marine and atmosphere monitoring missions.

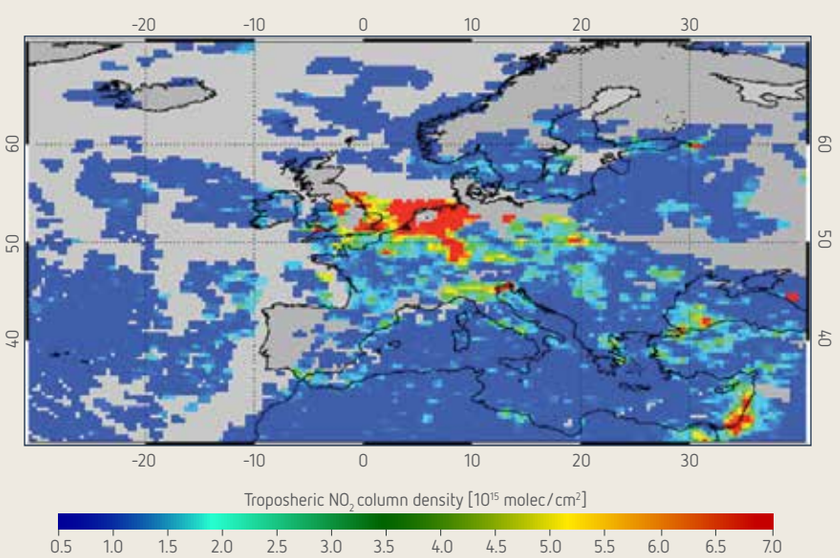
The Lisbon Treaty made space a shared competence between the European Union (EU) and its Member States, creating a new framework for the European Space Policy and paving the way for Copernicus, established in 2014 as the EU flagship Earth observation programme. Copernicus will "ensure an autonomous Union capacity for spaceborne observations and provide operational services in the field of atmosphere, marine, land and climate change monitoring, emergency management and security".

The efficient implementation of the Copernicus marine, atmosphere and climate change monitoring services calls for maximum synergy with operational meteorology, in particular with the strategic investments of EUMETSAT in operational space infrastructure. EUMETSAT, ESA and the EU therefore agreed in 2009 that the Copernicus Sentinel-4 and Sentinel-5 atmosphere monitoring missions would be implemented as part of EUMETSAT's MTG and EPS-SG satellite systems, based on additional instruments, and that EUMETSAT would operate the Sentinel-3 marine mission.

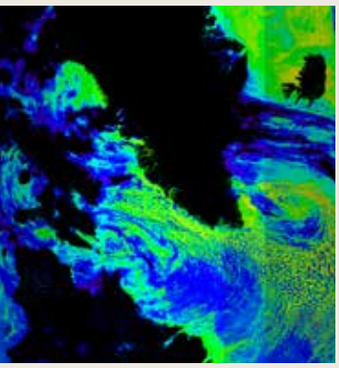
EUMETSAT presented the benefits expected from its role in Copernicus and the synergy with its own missions, infrastructure and data services at the EU Space Policy Conference in Brussels and to the EU Council Space Working Party chaired by the Greek EU Presidency during its visit to its headquarters. The working party was invited to "follow a Copernicus byte" from satellite observation to delivery of information to users through presentations by EUMETSAT and the providers of the Copernicus marine and atmosphere services, ECMWF and Mercator-Ocean.

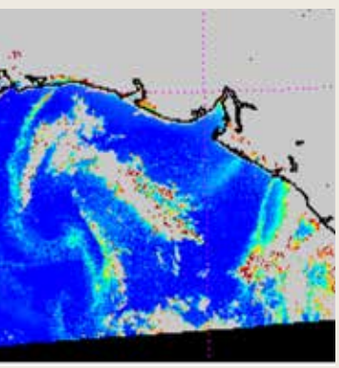
On 25 April, the entry into force of the Copernicus Regulation confirmed the foreseen role of EUMETSAT and called for the negotiation of a relevant agreement with the EU.

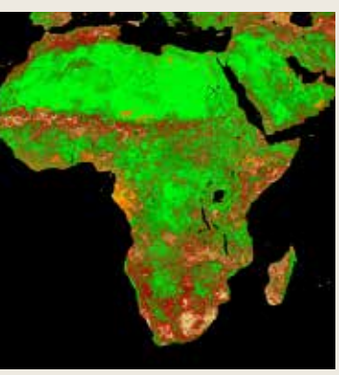
Alain Ratier, EUMETSAT Director-General and Philippe Brunet, Director of Aerospace, Maritime, Security and Defence Industries, EC Directorate General Internal Market, Industry, Entrepreneurship and SMEs, sign the agreement between the European Union and EUMETSAT on the implementation of the Copernicus programme



On 1 April, the GOME-2 instruments on EUMETSAT's Metop satellites observed a severe NO_2 pollution event over Germany, Belgium, the Netherlands and England. Air quality warnings were issued in all four countries.







Ocean colour (top) and aerosol (middle) products from the Suomi-NPP satellite and vegetation information (bottom) from PROBA V disseminated to Copernicus users via EUMETCast

After confirmation of EUMETSAT's eligibility by a "four-pillar" audit, these negotiations reached their final phase. Complex iterations were necessary due to late changes requested by the Commission to the cost recovery model and the indicative profile of commitment appropriations. This required an express vote by the EUMETSAT Council and confirmation that EUMETSAT's authority to conclude multi-annual contracts would not be impaired by the new appropriation profile. Both sides were happy to sign the agreement on 7 November, in Brussels, three weeks after the Council approved the third party programme providing the EUMETSAT legal framework for its implementation.

The tasks entrusted by the agreement are split into three building blocks:

- operations of the Sentinel-3, Jason-3 and Sentinel-6 marine missions and delivery of operational data and support services to the Copernicus Marine Environment Monitoring Service;
- operations of the Sentinel-4 and Sentinel-5 atmospheric composition monitoring missions as part of EUMETSAT's MTG and EPS-SG satellite systems and delivery of operational data and support services to the Copernicus Atmosphere Monitoring Service;
- delivery of other relevant mission data services, e.g. third party data available from EUMETSAT's international partners.

The third building block will capitalise on the EU-funded SNPP4Copernicus project that started to disseminate products from the US Suomi NPP satellite (sea surface temperature, aerosol optical thickness and ozone profiles) to fulfil requirements of the Copernicus marine and atmosphere services. Vegetation/Spot and PROBA-V products from VITO were also broadcast to African and European users on behalf of the Copernicus Land Service.

The internal management framework for Copernicus activities was then established through the tailoring of the EUMETSAT management system to EU requirements. Mr Dany Provost was appointed as the Copernicus Programme and Service Manager and the recruitment of 11 more Copernicus staff was initiated to populate the Programme Office and the divisions in charge of Sentinel-3 operations and delivery of Copernicus data services.

At the Copernicus Big Data Workshop organised by the Commission to discuss how the Copernicus infrastructure should evolve to offer equal access to Copernicus data to all users in the EU, EUMETSAT stressed that its EUMETCast system already offers this capability for Sentinel-3, -4, -5 and -6 data. The organisation also participated in the preliminary definition of an EU Copernicus.eu website interoperable with EUMETSAT and ESA data access infrastructures.

EUMETSAT concluded the assessment of user requirements for future Copernicus marine and atmosphere monitoring services performed on behalf of the Commission, under the co-funded GMES-PURE project.

EUMETSAT continued to promote the relevance of its cooperation with other satellite operators to the European Space Policy, through participation in the space dialogues between the EU and non-EU countries, in particular at the second EU-ESA-China meeting and the first EU-Japan meeting.

The Director-General participated in meetings of customers of European launch services called by the ESA Director-General in preparation of the ESA ministerial Council meeting, which he attended as an observer, and presented the socio-economic benefits of meteorological satellites at the XVIth European Inter-parliamentary Space Conference.

EUMETSAT's CEOS chairmanship established an initial plan for the implementation of the architecture for monitoring climate from space and fostered the dialogue with the World Climate Research Programme (WCRP).

The Climate Symposium 2014, was organised by EUMETSAT and WCRP

GLOBAL FRAMEWORK FOR CLIMATE SERVICES

Together with the World Meteorological Organization (WMO), EUMETSAT served as co-secretary of the task team formed by the African Union Commission, the African, Caribbean and Pacific Group of States (ACP) Secretariat and the Regional Economic Communities to implement the Global Framework for Climate Services (GFCS) in Africa, as foreseen by the Addis Ababa Declaration. In Benoni, on the eve of the 11th EUMETSAT User Forum in Africa, the African Union Commissioner for Rural Economy and Agriculture, the South African Minister of Environmental Affairs and representatives from all African stakeholders signed a political statement confirming their commitment to implement the GFCS in Africa and the Caribbean and Pacific regions, with the support of the EU.

At the invitation of WMO, EUMETSAT joined the Partners Advisory Committee (PAC) of the Intergovernmental Board on Climate Services (IBCS).

ARCHITECTURE FOR CLIMATE MONITORING FROM SPACE

The Architecture for climate monitoring from space entered its implementation phase during EUMETSAT's CEOS chairmanship, with the first meeting of the Joint CGMS-CEOS Working Group on Climate hosted in Darmstadt. The group will maintain an inventory of existing and planned Climate Data Records derived from satellite observations, plan the production of additional records and optimise the planning of future missions to expand these records and avoid data gaps.

EUMETSAT also hosted a meeting of the Executive Panel of the WMO SCOPE-CM initiative (http://www.scope-cm.org/) which reviewed the status of cooperative projects and highilighted the added value of international partnership for the cross-calibration of infrared imagery across the global geostationary fleet and the production of Climate Data Records.

CLIMATE SYMPOSIUM

EUMETSAT and the WCRP organised a Symposium on "Climate Research and Earth Observation from Space: Climate Information for Decision Making" in Darmstadt on 13-17 October, with the support of the European Commission. This key event of EUMETSAT's CEOS chairmanship was also sponsored by CEOS agencies and industry and opened by the German Minister in charge of space, Brigitte Zypries, other high level German officials and the Secretary-General of WMO, Michel Jarraud. More than 500 high level participants from 50 countries participated and another 500 persons followed the web streaming.

The programme, established by an independent international science committee, was structured around the six Grand Science Challenges of the WCRP - "clouds, circulation and climate sensitivity", "the changing water

cycle ", "cryosphere in a warming world", "ocean circulation and regional sea level rise", "prediction and attribution of extremes: from climate to weather", "regional climate variability and change: enabling climate services" - taking due account of the Fifth Assessment Report (AR5) of the Intergovernmental Panel of experts on Climate Change (IPCC), which was presented in the opening session by Prof Thomas Stocker, Chairman of IPCC Working Group I.

Two side events sponsored by the European space industry provided opportunities to introduce the Metop-SG, MTG and Copernicus Sentinel satellites to an international audience, thus highlighting European leadership in advanced Earth observation satellites and the competitiveness of its industry. The dialogue between early career scientists and research and space leaders was stimulated by a dedicated programme including coffee break discussions and awards for the best posters.

The specific need for and role of climate observations from space was discussed in relation to each Grand Science Challenge, and a round table involving decision makers from the energy, transport and insurance sectors addressed the criticality of climate information for the sustained development of their business.

The concluding round table gave leaders of operational and research space agencies and the European Commission the opportunity of a first response to the symposium's findings. The discussion with the audience acknowledged that only international cooperation can address the range of priorities of the research community, in particular through the Architecture for climate monitoring from space. It also stressed the unique potential of the combination of long term operational programmes and research missions, noting that some research missions need to be continued beyond one single satellite to gain full understanding of climate-critical processes. The continuation of the high precision ocean topography measurements expected from the international Sentinel-6/Jason-CS mission emerged as a top priority across several Grand Science Challenges.

All information on the Climate Symposium, including videos of the sessions, is available at www.theclimatesymposium.com.

CEOS AND GEO

EUMETSAT achieved all objectives announced in 2013 for its annual chairmanship of CEOS:

- The finishing touch was put to the new CEOS governance adopted in 2013, with the publication of the first CEOS three-year work plan and the positions of the CEOS Executive Officer and deputy were filled based on commitments by NOAA, the Canadian Space Agency and Geoscience Australia.

- The Joint CEOS-CGMS Working Group on Climate established the first three-year plan for the implementation of the Architecture for climate monitoring from space and the CEOS Plenary agreed to promote the conclusions of the Climate Symposium during the preparation of the 21st Conference of the Parties to the UN Framework Convention on Climate Change (COP 21).

- The new Working Group on Disaster Reduction established its work plan and actively prepared the CEOS contribution to the forthcoming conference on the second Hyogo Framework Agreement on Disaster Risk Reduction (HFA-2).

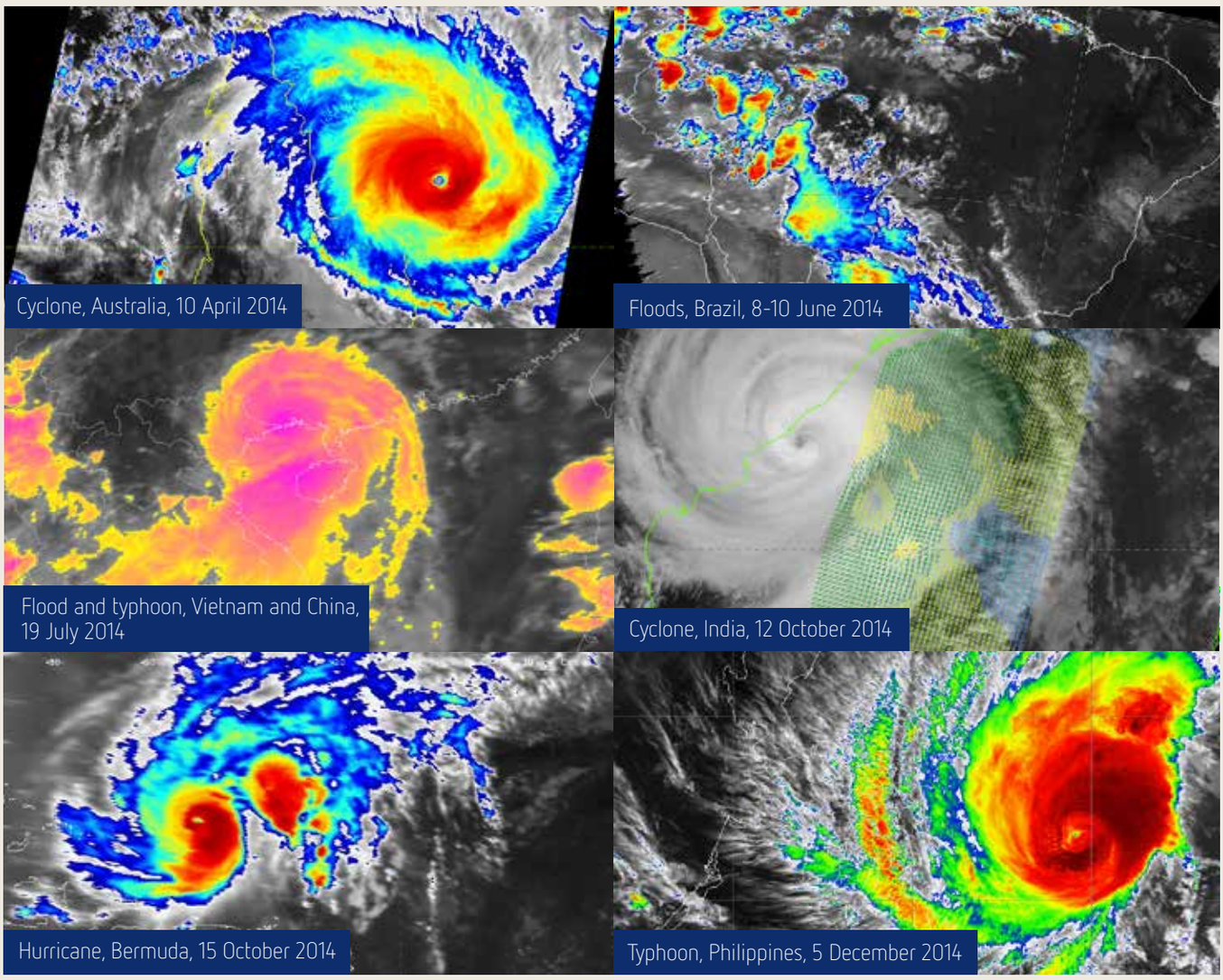
Thus, EUMETSAT's chairmanship prepared CEOS for the three strategic events planned in 2015, namely the UN World Conference on Disaster Risk Reduction in Sendai, Japan, COP 21 in Paris, France, and GEO's 12th Plenary Session and Ministerial Summit. CEOS's preparedness to contribute to all three events was the main thrust of the "Tromsoe Statement' released by the CEOS Plenary.

EUMETSAT's chairmanship came to an end at the closing ceremony of the CEOS Plenary meeting held in Tromsoe, Norway, on 29-30 October, where EUMETSAT handed over the chairmanship to JAXA. The Plenary itself was extremely successful thanks to the excellent support of the Norwegian Space Centre and the Norwegian Meteorological Service.

Within GEO, EUMETSAT NOAA and CMA continued to exchange data with and to support their worldwide dissemination through GEONETCast-Americas, CMACast and EUMETCast. Thus, the Hong Kong Observatory gained access to EUMETSAT data through CMACast. EUMETSAT's contribution to GEONetcast continued to be supported by the EU through the GMES Initial Operations (GIO) Global Land programme and the FP7 AGRICAB and SIGMA projects.

In January, EUMETSAT participated in the GEO-X Plenary and Ministerial Summit, in Geneva, also representing CEOS. It supported a GEO showcase on capacity building in Africa and teamed with WMO, NOAA and CMA to promote GEONETCast and its contribution to the Charter on Space and Major Disasters.

In 2014, EUMETSAT responded to eight activations of the Charter on Space and Major Disasters, in Africa, the Caribbean, India, Asia and Australia. Meteosat and Metop products were delivered to support crisis management related to floods in Zimbabwe (7 February), cyclone Ita in Australia (10 April), floods in Brazil (8-10 June), typhoons and floods in Vietnam and China (19-21 July), cyclone Hudhud in India (12 October), Gonzalo, the strongest hurricane to hit Bermuda for 11 years (15 October) and super typhoon Hagupit in the Philippines (5 December).



Imagery delivered by EUMETSAT is support of disaster management: cyclone Ita in Australia, floods in Brazil, typhoons in Vietnam and China, cyclone Hudhud in India, hurricane Gonzalo in Bermuda and super typhoon Hagupit in the Philippines

MANAGEMENT AND ADMINISTRATION

As part of continuous improvement, EUMETSAT obtained ISO 9001 recertification of its matrix management system, updated its procurement procedures and established a human resources strategy to prepare the optimum transition to a new generation of engineers.

ORGANISATIONAL MANAGEMENT

The matrix organisation was consolidated at all levels and a resource management framework supported by a web tool was established to assist in the management of human resources providing scientific and technical support to a portfolio of several projects.

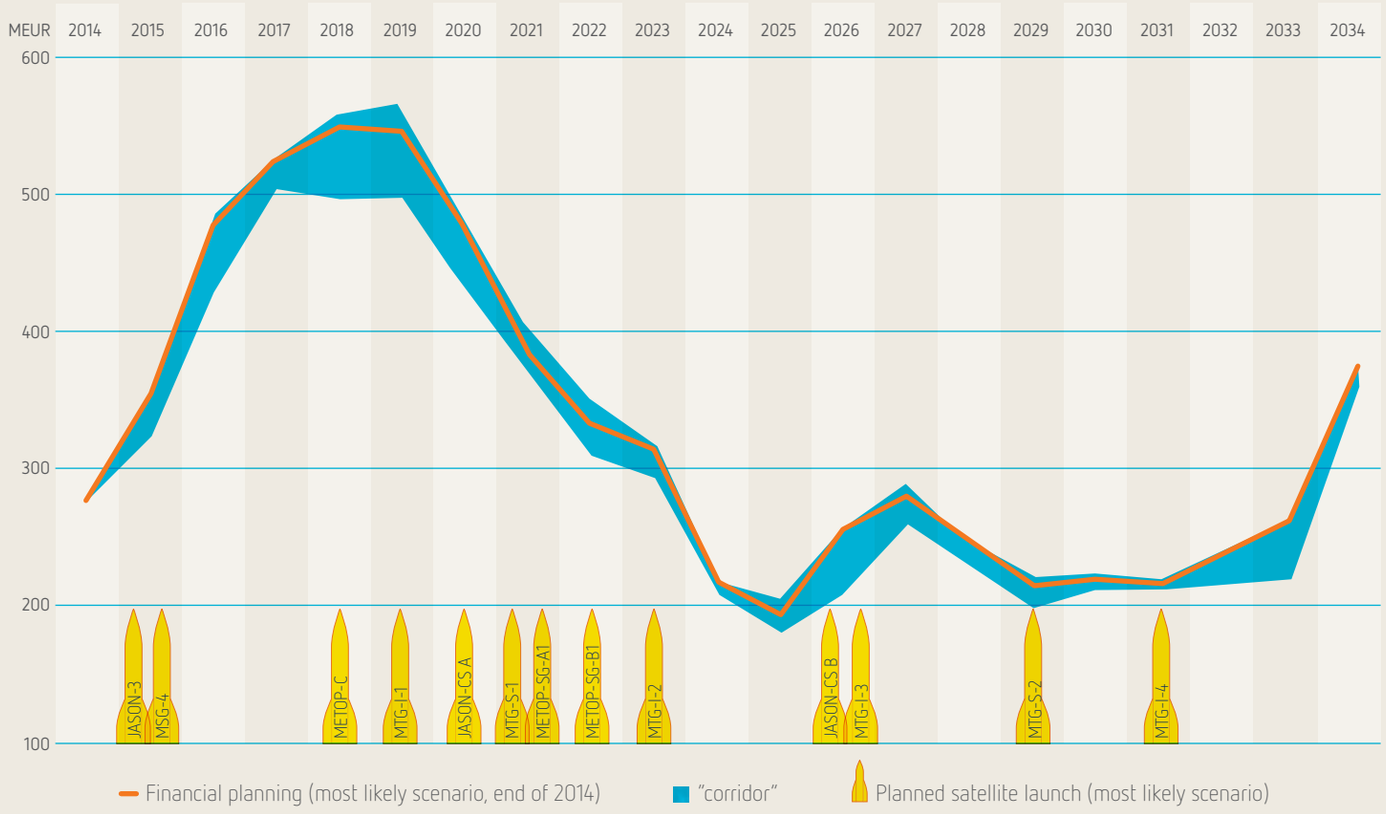
In December, after the first annual implementation cycle, feedback and proposals for improvements were sought from staff on the day-to-day implementation of matrix support to development programmes. The formulation of engineering and scientific support arrangements will be simplified by the standardisation of the definition of high level development tasks across the MTG and EPS-SG programmes.

New key performance indicators were introduced in the operations area to measure the availability of EPS and Meteosat data services to users against the reference of a perfect system, in addition to existing indicators measuring availability net of planned outages due to maintenance.

The harmonisation of the management support processes (quality assurance, configuration management, information management and project and planning control), aimed at simplifying existing local working practices through their alignment to a unique documented framework for each process, progressed with the publication of all frameworks. Three steering groups were established to assess the adequacy of corporate management support tools to business needs and guide their evolution, one for Enterprise Resource Planning (currently SAP) and Project Control tools, one for all information management tools and one for all engineering tools (DOORS, BEST, design tools, Dimensions, etc.).

The unit providing internal generic information and communications technology services was moved from Administration to the more technical environment of the Technical and Scientific Support Department, which has similar skills and responsibilities for maintenance and evolutions of operational IT systems, with the objective of improving cost efficiency through synergies. With the same objective, the unit was then restructured to separate the management of the demand and supply sides.

FINANCIAL PLANNING (CONTRIBUTIONS) 2014-2034



FINANCIAL PROCESSES

Financial planning foresees peaks in the years 2017 to 2020 as a result of the phased expenditure of the delayed MTG development programme and the beginning of the EPS-SG programme, but is still subject to significant changes over that period, considering that both programmes are still at an early development stage.

The ceiling of Member States' contributions to the General Budget for the period 2016-2020 was approved by the Council at a level of M€ 85.4 (2015 economic conditions), M€ 6.3 lower than in the period 2011-2015. This takes into account the fair contribution of the EU Copernicus programme to the costs of generic infrastructure and support functions.

A new scale of contributions applicable to mandatory programmes and to the General Budget entered into force for the years 2015-2017, reflecting the evolution of the economic situation in the period 2010-2012.

HUMAN RESOURCES MANAGEMENT

A demographic analysis showed that, while administrative staff members are fairly young, EUMETSAT engineers have an average age increasing above 50, with a number of highly experienced staff retiring during the MTG and EPS-SG development cycles. Though not unique in the space sector, this situation represents a significant risk for a medium size organisation with few large projects. Therefore, a human resources strategy was established to counteract the effects of ageing, whereby the grade bands of about 50 posts were broadened both downwards to recruit young talents and upwards to offer a career perspective to senior experts mentoring less experienced staff. A few posts will be selected for recruitment at lower grade for a two-year contract as part of an early career programme.

The concept of HR business partnering, whereby a human resources specialist provides end-to-end support to a department, from recruitment to training, started to be generalised to gain the in-depth knowledge needed for optimum management of human resources. Likewise, a skill assessment process measuring the availability of business-critical skills against foreseeable needs and identifying gaps was validated in one

MAIN CONTRACT PROPOSALS AND FINANCIAL AGREEMENTS APPROVED BY COUNCIL

Contractual implications of the postponement of MSG-4 launch to summer 2015
MTG Mission Data Acquisition Ground Stations Facility
MTG Telemetry, Tracking and Commanding Ground Stations Facility
Repair of the IASI instrument for the Metop-C satellite
SAP system maintenance and enhancement/project support services for the period 1 October 2014 – 30 September 2019
EPS Back-Up Control Centre Site Service Extension until 2020
MSG Spacecraft Routine Operations Support until 2019
Svalbard Fibre Link Communication Service Extension until 2020
EPS Mission Control System Maintenance Service Extension until 2020
EPS Svalbard CDA Maintenance Service Extension until 2020
EUMETCast Africa Service Extension until July 2018
Agreement with ESA for the development/procurement of the Metop-SG satellites
Agreement with CNES for the development/procurement of the IASI-NG instruments
Agreement with DLR for the development/procurement of the METImage instruments
Agreement with NOAA on the Joint Polar System
Agreement with the European Union on EUMETSAT support to Copernicus
Ammendment to the Implementation Arrangement with ESA on the development of Sentinel-3

department. It will be generalised to provide key inputs to training plans and overall human resource planning.

The family policy was modernised to introduce dedicated paternity, parental and adoption leave.

A staff survey, backed by a dedicated internal communication campaign, was conducted during the last quarter, attracting a very high response rate of 84%. Analysis of the results and the response was scheduled to be presented to staff and Council in 2015.

PROCUREMENT PROCESS

Procurement procedures were updated to reflect the current EUMETSAT best practices and international public procurement standards. The evaluation weightings are now communicated with invitations to tender for procurements above M€ 1.5 and contract award data are published ex post for all open competitive procurement actions. Contractors have been made aware of the anti-fraud policy, which includes EUMETSAT's right to cancel contracts in case of violation.

Furthermore, a frame contract procedure was introduced, which ensures schedule and volume flexibility by bulking procurements for a range of goods, supplies, services or works. This was first used for the procurement of Copernicus Sentinel-3 operations support.

Industry Information Days were organised in Estonia and Poland to present the EUMETSAT procurement rules and forthcoming opportunities to national Industry, and in Darmstadt, to present each major ITT ahead of its release. The annual meeting of Industry Focal Points was held in at Headquarters on 30 September.

QUALITY MANAGEMENT

After a successful audit held on 12-14 November, EUMETSAT was recertified ISO 9001:2008 for another three years by DQS GmbH. This confirmed the ISO compliance of the implemented matrix organisation and of the framework established for the management of Copernicus activities. The scope of the certificate was revised to cover Copernicus activities.

GENERAL INFRASTRUCTURE AND SERVICES

The construction of the New Office Building (NOB) started in January and the cornerstone laying ceremony took place on 7 April. The steel concrete skeleton was finalised ahead of schedule but the closing of the shell, including the glass façade and the roofing, had to be postponed to 2015, due to adverse weather conditions.

Funded entirely by the entry fees of new Member States, the NOB can accommodate all staff currently hosted in rented offices but only part of the additional human resources involved in the new MTG, EPS-SG, Copernicus and Jason-CS programmes. Therefore, rental of temporary office containers was prepared, together with an overall accommodation plan optimising the use of all the office space available.

The new general telecommunication service contract was implemented, including migration to new mobile phones. The performance of notebooks outside EUMETSAT was improved by an update of Windows and a new version of the Document Management Tool was rolled out.

INTERNAL CONTROL AND RISK MANAGEMENT

The internal control framework was consolidated with the publication of the internal audit charter and the decision of the Administrative and Finance Group to serve as the Audit Committee, after the revision of its terms of reference by the Council. The anti-fraud policy was formalised and dedicated training on it began.

Management of operational risks focused on investigations of anomalies that may introduce single points of failure in satellite systems, either on the ground or in orbit.

In orbit, the main issue was the anomaly encountered in January, when Meteosat-9 autonomously switched over from the nominal to the redundant mission-critical remote terminal unit (RTU). Meteosat-9 continued to work but the investigation found similarities with an anomaly which has left Meteosat-8 with a suspected single point of failure since 2003. After a comprehensive analysis demonstrated that the risk of switching back both spacecraft to the nominal RTU was lower than doing nothing, the swap back was executed first on Meteosat-8, in view of its higher depreciation, and then on Meteosat-9, both successfully. This restored full redundancy on both spacecraft and increased the predicted lifetime of Meteosat-8 by six months.

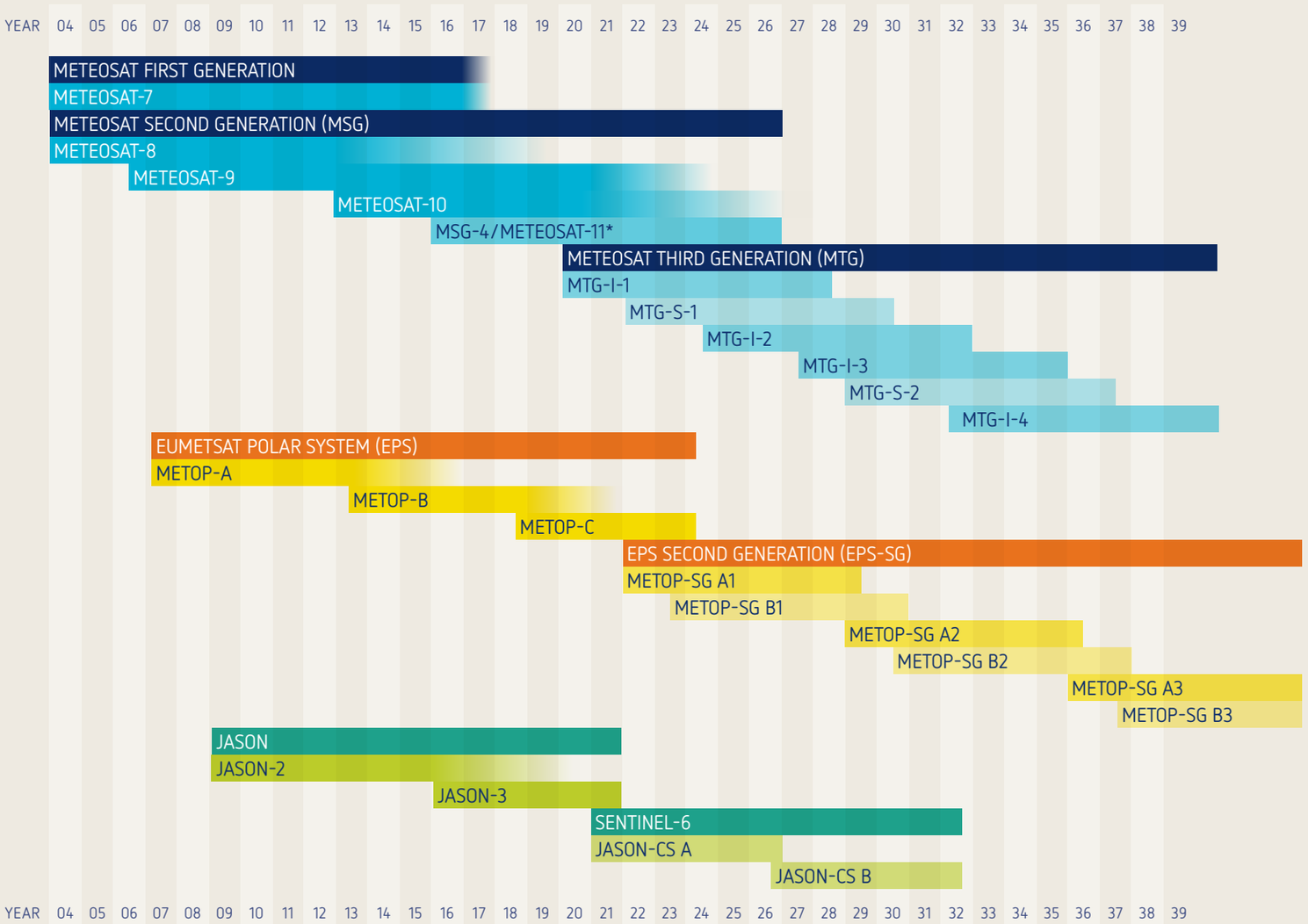
Cornerstone laying ceremony of the New Office Building, involving the German Federal Ministry of Transport and Digital Infrastructure, the Minister for Federal and European Affairs of Hesse and the Lord Mayor of Darmstadt

On the ground, the enquiry board established in 2013 concluded that the collapse of one Meteosat antenna at Usingen was due to several factors amplifying original weaknesses of some mechanical parts. The observability of mechanical anomalies and the related maintenance procedures were reinforced for all antennas and the operational risk was mitigated by the accelerated upgrade of another antenna located in Fucino.

The systems and procedures aimed at securing the continuity of core data services in case of a disaster were further tested. The deployment of the operations teams to the Operations Emergency Coordination Room (OECR) hosted by Deutscher Wetterdienst (DWD) in Offenbach demonstrated the capability to safely control all spacecraft in the event of an evacuation of the headquarters, and a simulated outage of the commercial power supply confirmed the availability and performance of the emergency power supply systems.

The frequency protection agenda was dominated by the preparations for World Radiocommunication Conference 2015. Coordinated actions with partner agencies, the European Commission and WMO aimed at preserving the frequencies used to command EUMETSAT satellites (2025-2110 MHz/2200-2290 MHz) and to measure ocean surface wind and sea level with the radars of Metop-SG, Jason and Sentinel-3 (5.35-5.47 GHz and 13.4-13.75 GHz).

EUMETSAT MISSION PLANNING



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

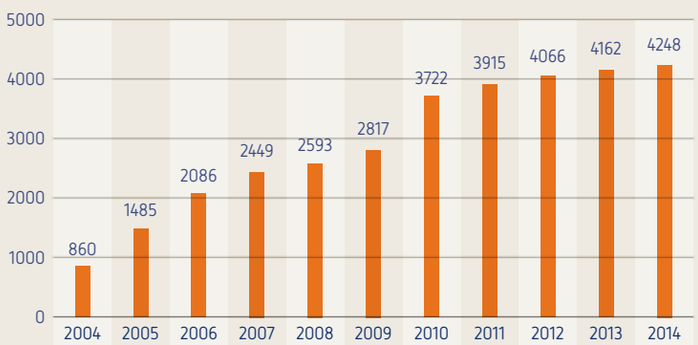
* MSG-4/Meteosat-11 will be stored in orbit, before replacing Meteosat-10

THE EUMETSAT USER BASE

The EUMETSAT user base is comprised of users in the NMSs of its Member and Cooperating States, ECMWF, international partners and a number of licensed users. At the end of 2014, the number of licensed users was 2,095.

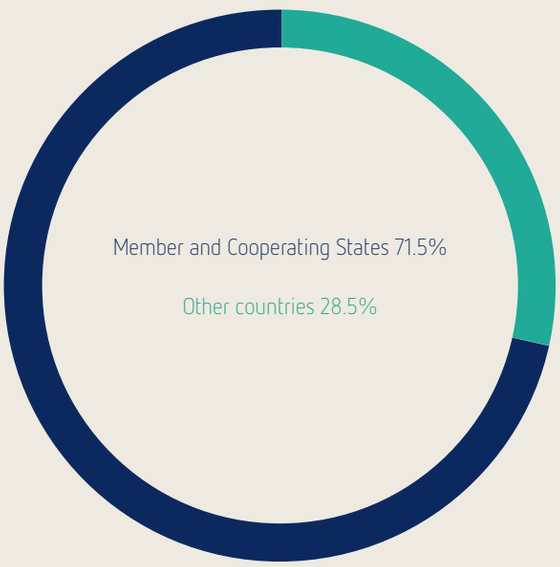
EUMETCAST USERS

At the end of the year there were 4,248 registered EUMETCast reception stations, of which 85% were located in Member and Cooperating States, and 3,312 users.



USER ENQUIRIES

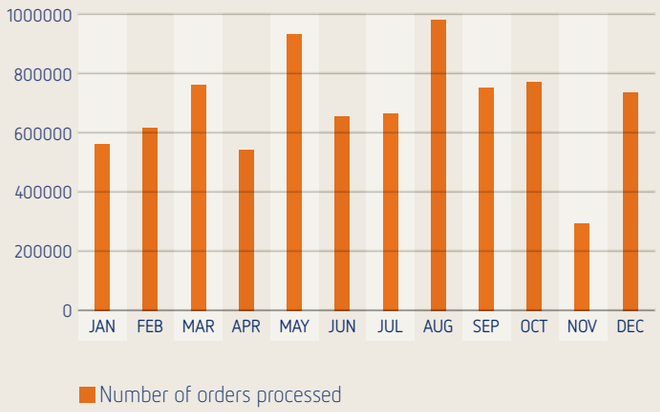
A total of 3,547 user enquiries were processed

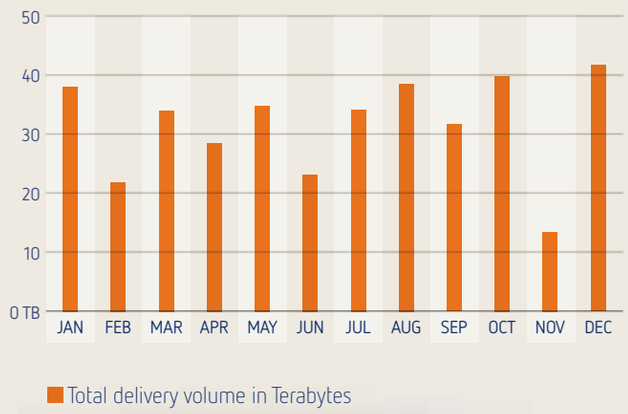


OPERATIONAL PERFORMANCE INDICATORS

DATA CENTRE USERS AND ORDERS

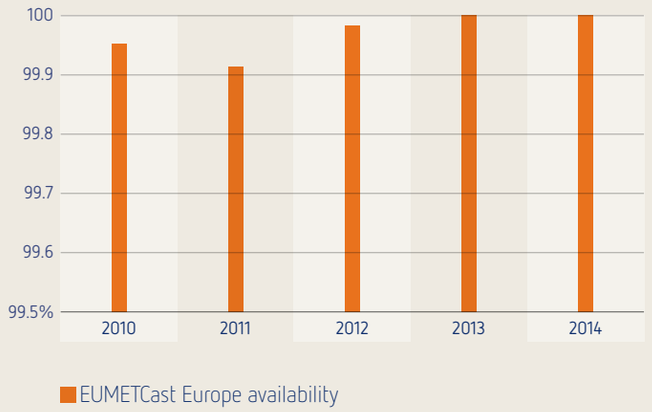
Almost 3,000 registered users were signed up to acquire archived data at the end of 2014. On average, there were 46 new registrations per month and 194 users a day accessed the Data Centre Online Ordering Tool for search and ordering.





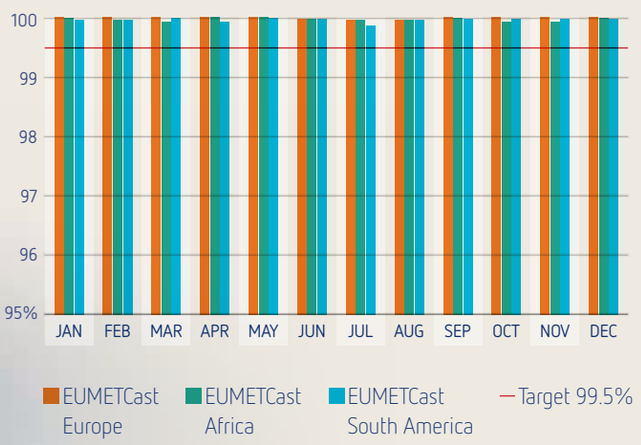
EUMETCAST EUROPE AVAILABILITY 2010-2014

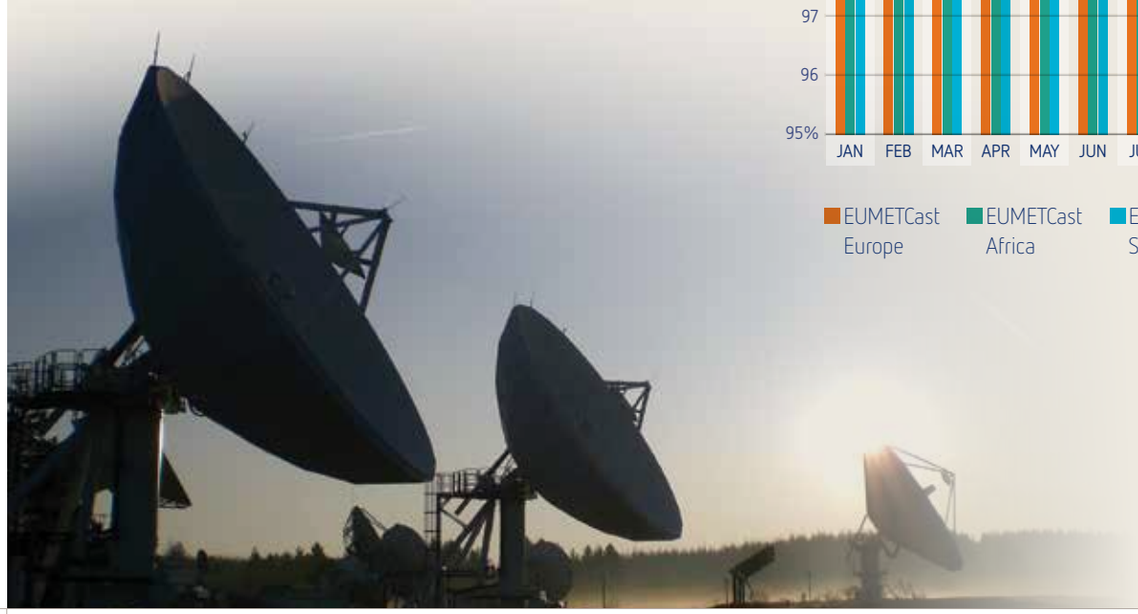
The availability of EUMETCast Europe remained at a record-breaking high level of 99.99% throughout 2014.



EUMETCAST AVAILABILITY 2014

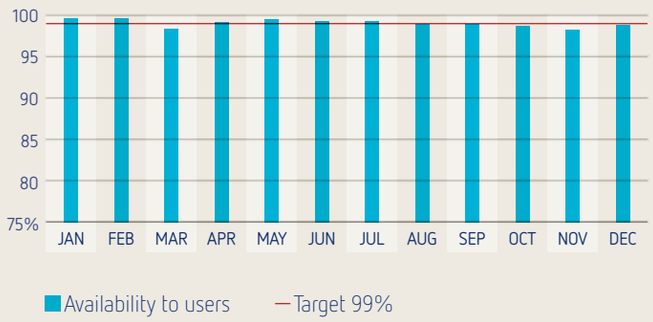
The total unavailability of EUMETCast in 2014 was 49 minutes for EUMETCast Europe and 3 hours for EUMETCast Africa and America.





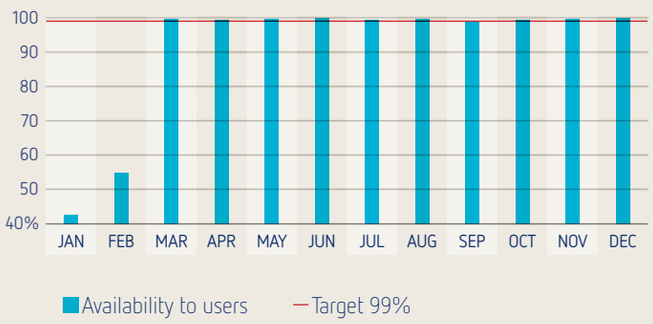
AVAILABILITY OF METEOSAT SEVIRI FULL DISC IMAGE DATA (0°)

The availability was marginally impacted by eclipse conditions in March and September, and by ground segment anomalies in October/November.



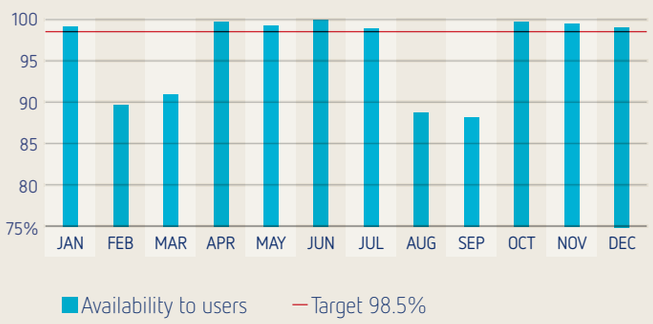
AVAILABILITY OF METEOSAT SEVIRI RAPID SCAN DATA (9.5°E)

The RSS was paused from 14 January to 13 February.

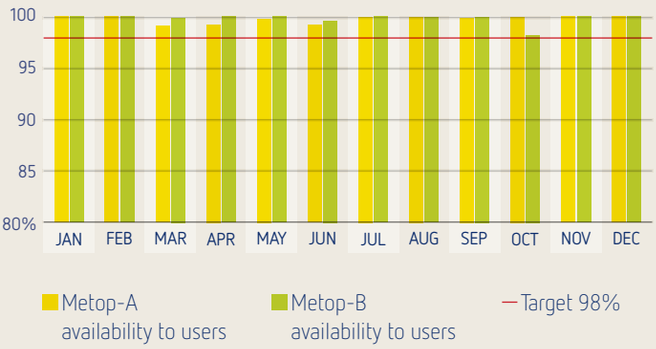


AVAILABILITY OF METEOSAT IODC IMAGE DATA (57.5°E)

Availability was impacted by eclipse conditions in February-March and August-September.

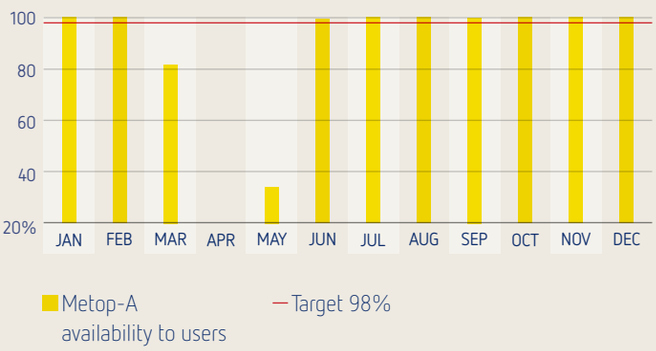


AVAILABILITY OF METOP AMSU LEVEL 1B BUFR DATA

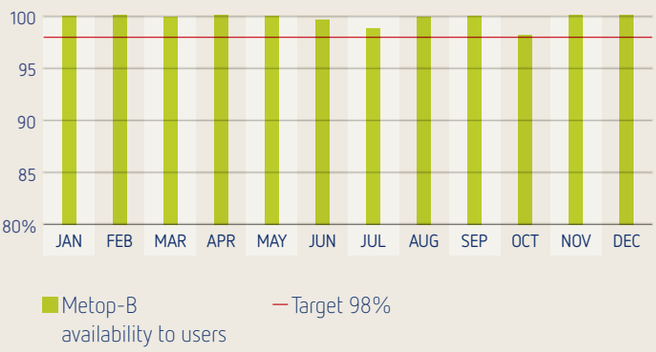


AVAILABILITY OF METOP-A MHS LEVEL 1B BUFR DATA

The service was interrupted from 26 March to 21 May due to an instrument anomaly.



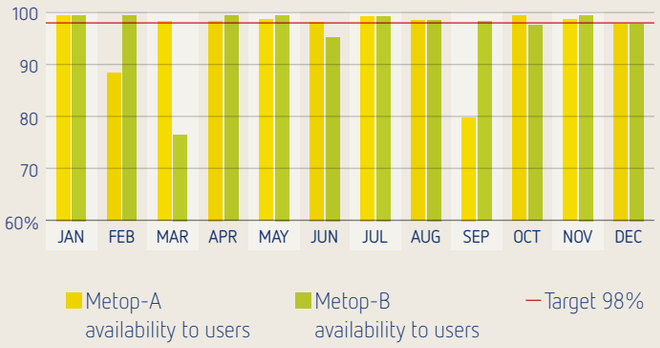
AVAILABILITY OF METOP-B MHS LEVEL 1B BUFR DATA



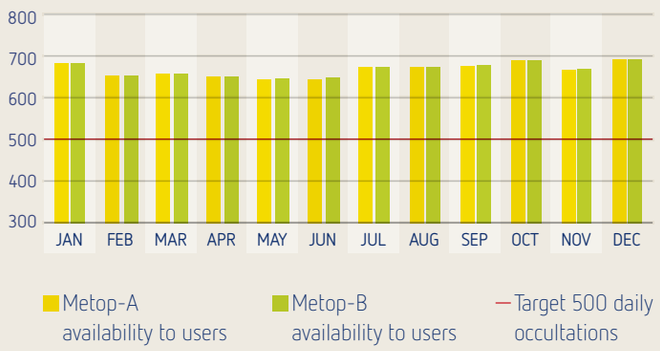
OPERATIONAL PERFORMANCE INDICATORS

AVAILABILITY OF METOP IASI LEVEL 1C BUFR DATA

The availability was impacted by instrument anomalies in February (Metop-A), March and June (Metop-B), and by planned instrument decontamination in September (Metop-A).

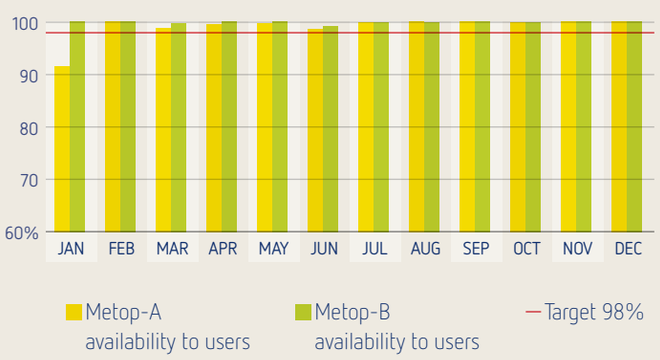


AVAILABILITY OF METOP GRAS LEVEL 1B DATA

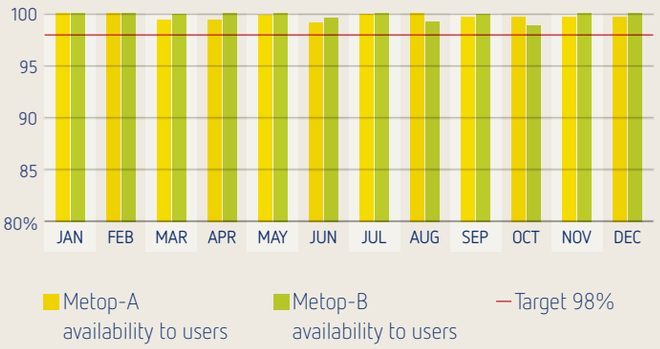


AVAILABILITY OF METOP GOME-2 LEVEL 1B DATA

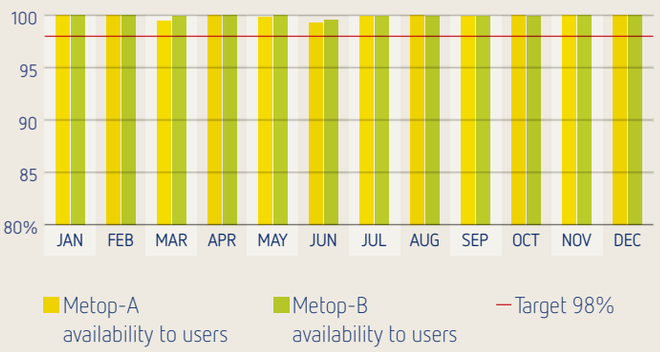
The availability was reduced in January due to an instrument anomaly on Metop-A.



AVAILABILITY OF METOP ASCAT LEVEL 1B DATA

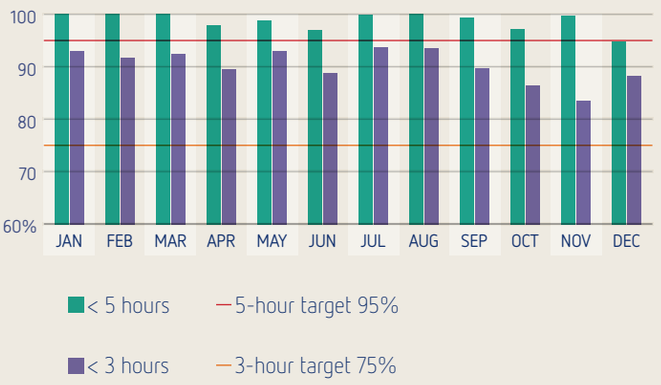


AVAILABILITY OF METOP AVHRR LEVEL 1B DATA



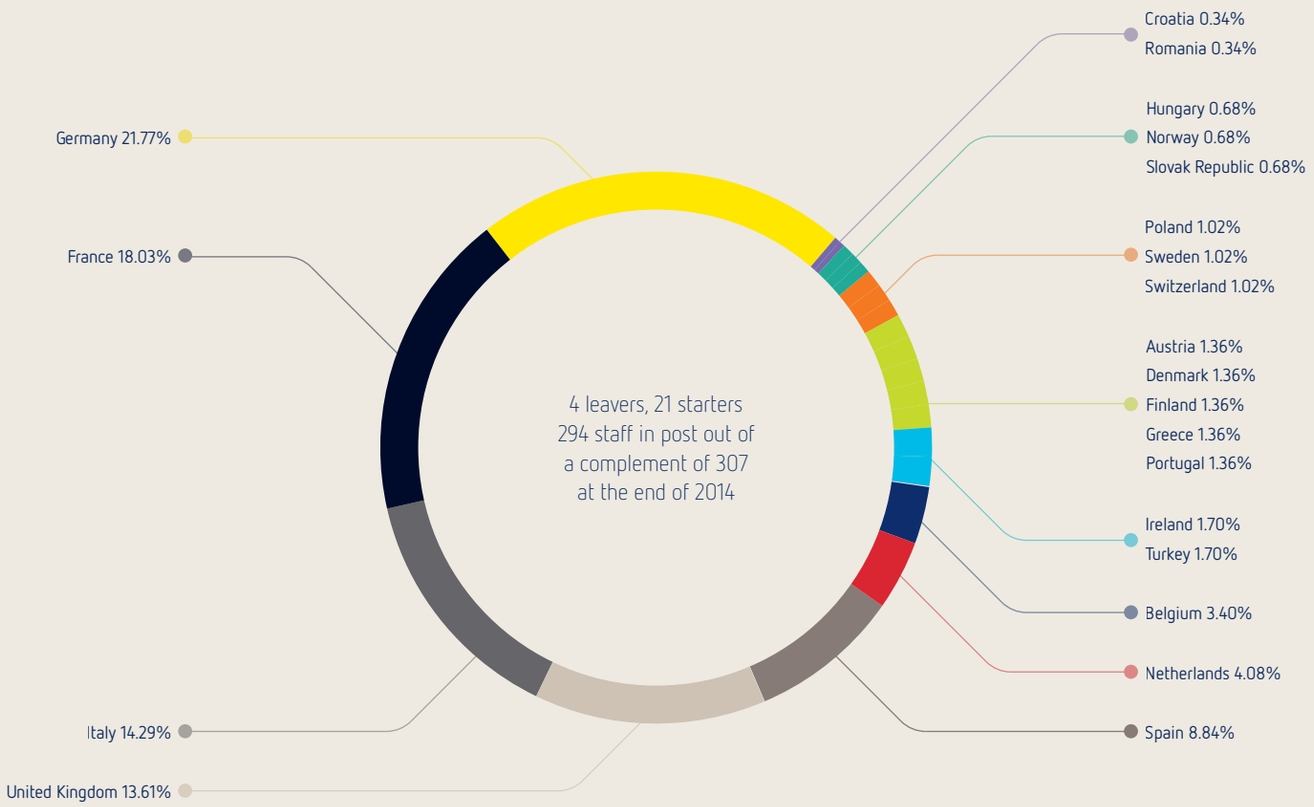
AVAILABILITY OF JASON-2 OPERATIONAL GEOPHYSICAL DATA RECORDS

The availability was marginally impacted by a microwave radiometer anomaly.



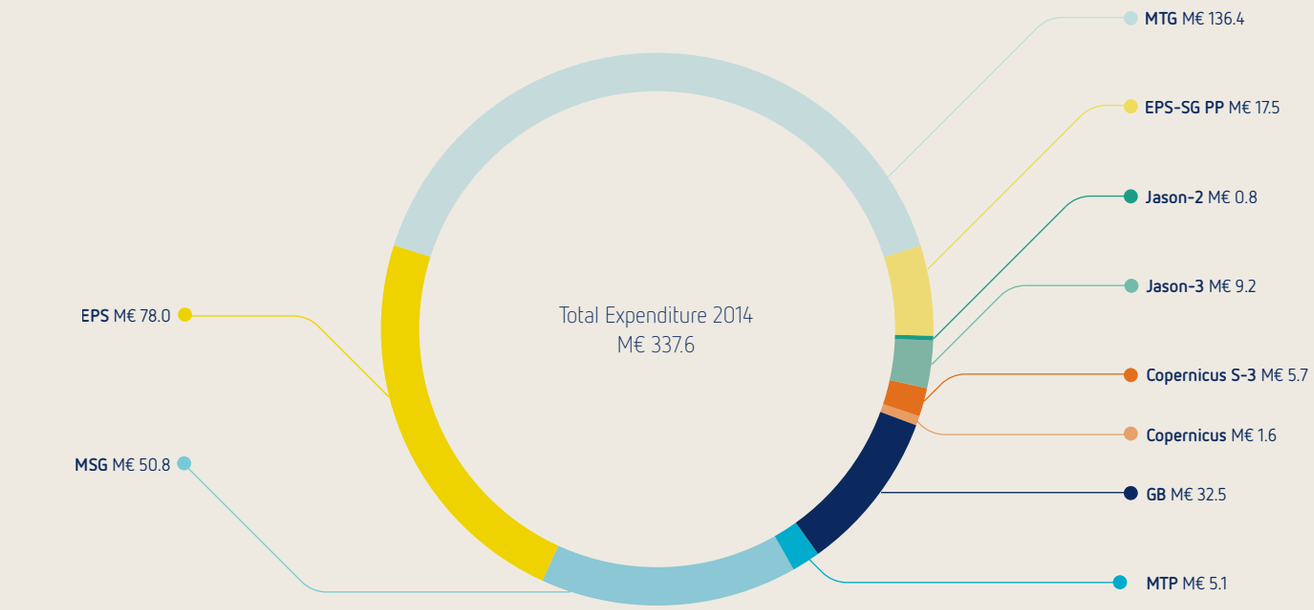
HUMAN RESOURCES

STAFF IN POST
31 December 2014



FINANCIAL INFORMATION

EXPENDITURE BUDGETS



FINANCIAL INFORMATION

The 2014 EUMETSAT's Financial Statement has been audited by the Bundesrechnungshof. The following tables, in K€, are a summary of the information for 2014 included in those accounts.

SUMMARY REVENUE AND EXPENDITURE 2014

	KEUR
REVENUE	
Member and Cooperating State Contributions	269,101
Other Contributions	19,708
Tax on Salary	17,272
Sales Revenue	1,881
Other Revenue	42,542
Asset Impairments	487
TOTAL REVENUE	**350,991**
EXPENDITURE	
Costs for Human Resources	96,319
Other Operating Expenses	8,948
Satellites related costs	25,539
SAF, Prospective Activities, Research Fellows	11,327
Depreciation	60,515
Asset Impairments	0
TOTAL EXPENDITURES	**202,648**
Revenue from Financial Operations	867
NET SURPLUS FOR THE PERIOD	**149,210**
Surplus to be distributed to Member and Cooperating States	15,324
Result Allocated to Reserves	133,886

SUMMARY BALANCE SHEET 2014

	KEUR
ASSETS	
Current assets	614,155
Non-Current assets	1,821,840
TOTAL ASSETS	**2,435,995**
LIABILITIES	
Current Liabilities	470,555
Non-Current Liabilities	151,185
TOTAL LIABILITIES	**621,740**
TOTAL NET ASSETS/EQUITY	**1,814,255**
TOTAL LIABILITIES & NET ASSETS/EQUITY	**2,435,995**

MEMBER AND COOPERATING STATES CONTRIBUTIONS 2014

	KEUR
MEMBER STATE CONTRIBUTIONS	
Austria	5,394
Belgium	6,947
Bulgaria	331
Switzerland	6,812
Czech Republic	2,533
Germany	49,728
Denmark	4,673
Estonia	291
Spain	20,972
Finland	3,657
France	39,415
United Kingdom	37,148
Greece	4,514
Croatia	890
Hungary	1,854
Ireland	3,060
Iceland	67
Italy	30,880
Lithuania	573
Luxembourg	584
Latvia	416
Netherlands	11,611
Norway	5,731
Poland	6,289
Portugal	3,312
Romania	2,483
Sweden	6,653
Slovania	703
Slovakia	1,172
Turkey	7,103
TOTAL MEMBER STATES CONTRIBUTIONS	**265,796**
COOPERATING STATE CONTRIBUTIONS	
Bulgaria	317
Iceland	130
Serbia	271
TOTAL COOPERATING STATE CONTRIBUTIONS	**718**
TOTAL MEMBER AND COOPERATING STATES CONTRIBUTIONS	**266,514**

ORGANISATION, 1 JANUARY 2015

Director-General
Alain Ratier

Financial Control
J. Travesi Garcia

Prof A. Eliassen (Chairperson)
Norwegian Meteorological Institute

Mr I. Cacic (Chairperson)
Meteorological and Hydrological Service of Croatia

EUMETSAT Council

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)

Dr G. Seuffert (Chairperson)
Ms E. Lábó (Vice-Chairperson

Administrative and Finance Group (AFG)

Mr A. Rubli (Chairperson)
Mr P. Santoni (Vice-Chairperson)

Data Policy Group (DPG)

Mr Vladan Kocic (Chairperson)

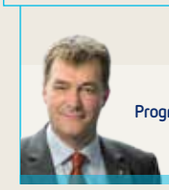
EUMETSAT Advisory Committee of Cooperating States (EACCS)

Chief Scientist
Dr J. Schmetz

Communication and Information Services
C. Ritsert-Clark

Quality Management and Assessment
G. Bernède

Strategy and International Relations
P. Counet



Director of Programme Preparation and Development
Clemens Kaiser

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

Low Earth Programmes
Dr M. Cohen

Flight Operations
M. Williams

Real Time Services and System Operations
S. Burns

User Support and Climate Services
Dr V. Gärtner

Contracts
E. Katsampani

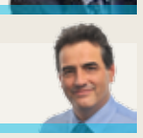
Finance
P. Collin

General Services
B. Kaufmann

Personnel
F. Brazil

Legal Affairs
Vacant

Process Assurance and Management Support
L. Sarlo



Generic Systems and Infrastructure
G. Mori

Remote Sensing and Products
K. Holmlund

System Engineering and Projects
J. González Picazo

APPENDIX

EUMETSAT COUNCIL DELEGATES AND ADVISORS, 1 JANUARY 2015

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

Prof Dr G. Kortchev	National Institute of Meteorology and Hydrology (NIMH)
Dr C. Georgiev	NIMH

CROATIA

Mr I. Čačić	Meteorological and Hydrological Service (DHMZ)
Dr B. Lipovščak	DHMZ
Mr D. Tomsic	DHMZ
Ms V. Tutis	DHMZ

CZECH REPUBLIC

Mr V. Dvořák	Czech Hydrometeoro-logical Institute (CHMI)
Mr M. Setvák	CHMI
Ms K. Nedbalová	Ministry of Environment of the Czech Republic

DENMARK

Ms M. Thyrring	Danish Meteorological Institute (DMI)
Mr H.S. Andersen	DMI
Mr C. Eskebjerg	DMI

ESTONIA

Mr J. Mandel	Estonian Environment Agency

FINLAND

Prof P. Taalas	Finish Meteorological Institute (FMI)
Dr. Y. Viisanen	FMI
Prof S. Joffre	FMI
Ms M. Hurtola	FMI
Mr M. Viljanen	FMI

FRANCE

Mr J.-M. Lacave	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 J. Saalmüller	Deutscher Wetterdienst
Dr G. Seuffert	Bundesministerium für Verkehr-, Bau- und Stadtentwicklung
Dr C. Brüns	Deutsches Zentrum für Luft-und Raumfahrt (DLR)

GREECE

Brig Gen D. Konidaris	Hellenic National Meteorological Service

HUNGARY

Ms K. Radics	Hungarian Meteorological Service (OMSZ)

ICELAND

Dr A. Snorrason	Icelandic Meteorological Office (IMO)
Mr I. Kristinsson	IMO

IRELAND

Mr L. Campbell	Met Éireann

ITALY

Lt Col. L. De Leonibus	Ufficio Generale per la Meteorologia
Mr P. Rosci	Ufficio Generale per la Meteorologia
Dr F. Battazza	Agenzia Spaziale Italiana

OBSERVERS

EACCS Chairperson (Serbia)
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

Mr G. Van der Steenhoven	Koninklijk Nederlands Meteorologisch Instituut

NORWAY

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

POLAND

Prof M. Ostojski	Institute for Meteorology and Water Management
Ms E. Wozniak-Dudzinska	Institute for Meteorology and Water Management
Dr P. Struzik	Institute for Meteorology and Water Management

PORTUGAL

Prof M. Miranda	Istituto Portugues do Mar e da Atmosfera (IPMA)
Dr P. Viterbo	IPMA

ROMANIA

Dr I. Sandu	National Meteorological Administration (RNMA)
Dr G. Stancalie	RNMA

SLOVAK REPUBLIC

Dr M. Benko	Slovak Hydrometeoro-logical Institute

SLOVENIA

Dr K. Bergant	Slovenia Environmental Agency

SPAIN

Mr M.A. López Gonzáez	Agencia Estatal de Meteorologia (AEMET)
Dr F. Belda	AEMET
Mr M. Palomares	AEMET
Mr E. Vez	Centro para el Desarrollo Tecnologico Industrial
Mr R. Trigo	Centro para el Desarrollo Tecnologico Industrial

SWEDEN

Mr R. Brennerfelt	Swedish Meteorological and Hydrological Institute (SMHI)
Mr S. Nilsson	SMHI

SWITZERLAND

Dr P. Binder	MeteoSwiss
Mr A. Rubli	MeteoSwiss
Ms G. Seiz	MeteoSwiss

TURKEY

Mr I. Gunes	Turkish State Meteorological Service
Mr E. Erdi	Turkish State Meteorological Service
Ms E.A. Bozoglu Bille	Turkish State Meteorological Service

UNITED KINGDOM

Mr R. Varley	Met Office
Mr B. Truscott	Met Office
Mr S. Turner	MetOffice

APPENDIX

PARTICIPATION IN MAJOR EXTERNAL EVENTS IN 2014

15-17 January	GEO X Plenary and Ministerial meeting, Geneva, Switzerland
28-29 January	EU Space Policy Conference, Bruxelles, Belgium
2-6 February	94th AMS Annual Meeting 2014, Atlanta, USA
6 February	EC-AUC Space Troika Meeting, Addis Ababa, Ethiopia
6-7 February	2nd MESA Project Steering Committee meeting, Addis Ababa, Ethiopia
10-12 February	Partner consultative meeting on the Implementation Plan of Integrated African Strategy on Meteorology, Addis Ababa, Ethiopia
9-10 April	29th meeting of the CEOS Strategic Implementation Team (SIT), Toulouse, France
12-13 May	Greek EU Presidency Copernicus Event, Athens, Greece
19-23 May	42nd CGMS Plenary session, Guangzhou, China
2-4 June	Workshop on Disaster Resilience in Africa, Darmstadt, Germany
4-6 June	GFCS Task Team Meeting, Darmstadt, Germany
6 June	EU-US Dialogue on Space, Madrid, Spain
12 June	EU-China Dialogue on Space, Brussels, Belgium
17 June	Meeting of EU Council Space Working Party, Darmstadt, Germany
18-28 June	66th session of the WMO Executive Council, Geneva, Switzerland
16-20 June	12th International Winds Working Group, Copenhagen, Denmark
7-11 July	AMS Radiation Conference and Tony Slingo Symposium, Boston, USA
16-21 August	World Weather Open Science Conference, Montreal, Canada
8-10 October	4th Climate Change and Development Conference in Africa (CCDA-IV), Marrakesh, Morroco
20-21 October	16th European Inter parliamentary Space Conference, Paris, France
27-31 October	28th CEOS Plenary, Tromsoe, Norway
10-12 November	3rd MESA Project Steering Committee meeting, Addis Ababa, Ethiopia
13-14 November	GEO-XI Plenary Session, Geneva, Switzerland
19-21 November	Asia-Oceania Meteorological Satellite Users Conference, Shanghai, China
14-17 December	GMES and Africa Coordination Team Meeting, Tunis, Tunisia

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APPENDIX

SCIENTIFIC AND TECHNICAL PUBLICATIONS IN 2014

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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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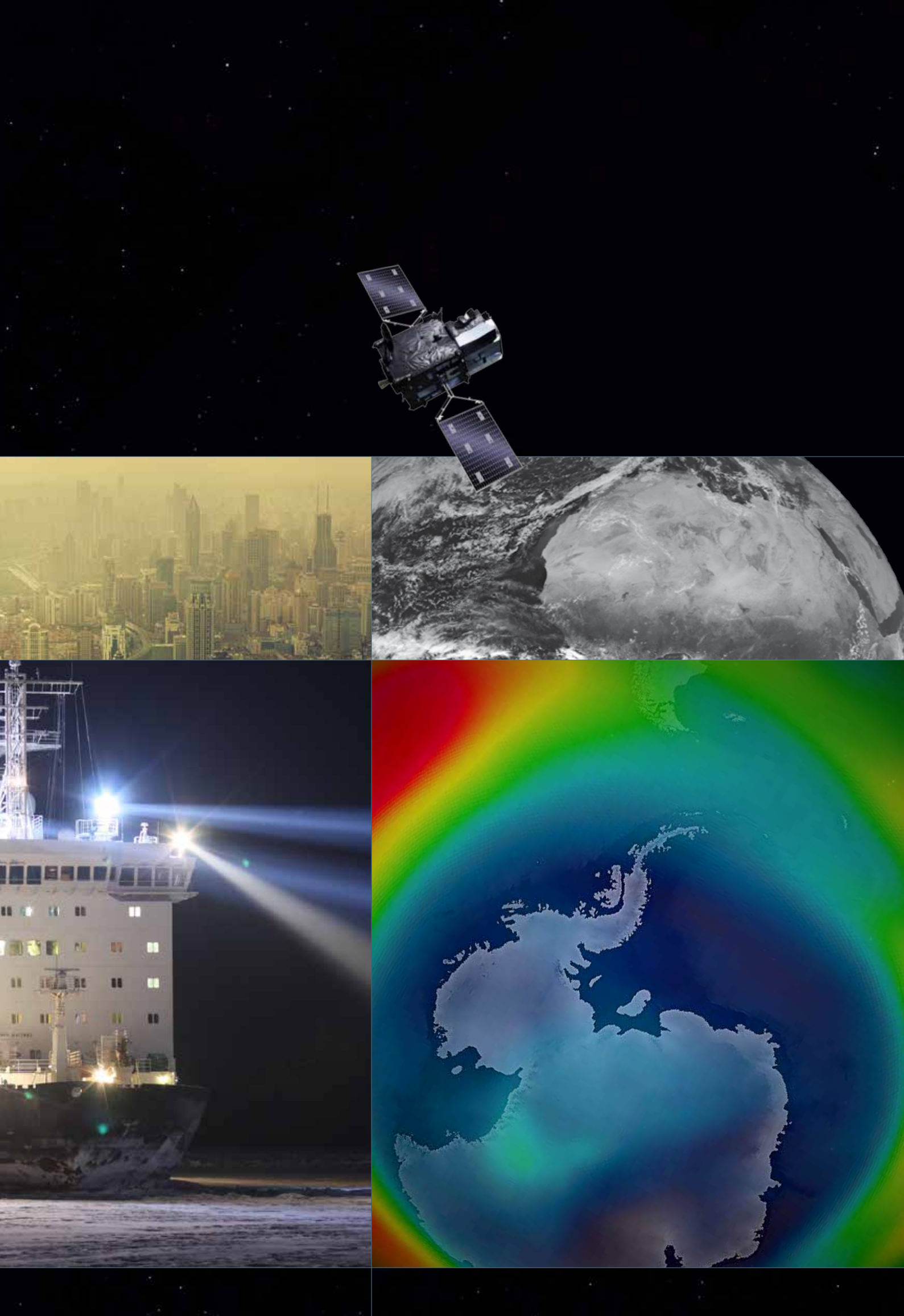

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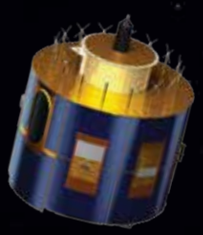

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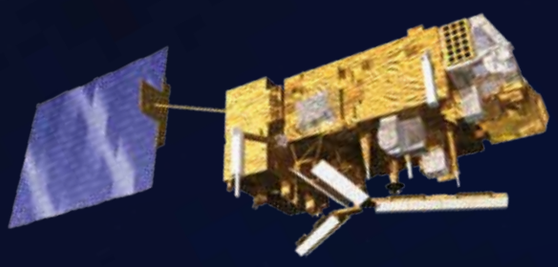

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