EUMETSAT Headquarters Darmstadt, Germany

Central Operations Report: July to December 2019

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Any service changes introduced in the reporting period are presented on our website:

www.eumetsat.int, under 'Data' → 'Service Status' → 'Product History'

Introduction

Welcome to the Central Operations Report for the second half of 2019.

The half-year kicked off with the Metop-C satellite being declared operational on 3 July. This was the culmination of more than half a year of intensive satellite and instrument commissioning and verification activities since Metop-C's launch in November 2018.

All Metop-C instrument data have been added to the Global and Regional Data Services, and the service availability slides in this report now cover the data of all 3 Metop satellites. It is planned to continue Metop-A operations and the provision of its data until the end of 2021.

As the performances of the AMSU and MHS microwave sounders of Metop-C are inferior to those of Metop-B, Metop-B was kept as the prime Metop satellite dumping data twice per orbit to Svalbard and Mac Murdo for improved timeliness of Global Data Services.

Initially, Metop-C joined its two siblings in orbit, Metop-A and Metop-B, in a 'tristar formation'. In December 2019, it began a drift in its orbit plane to achieve a 'trident' configuration. This manoeuvre was successfully completed on 19 February 2020.

One satellite comes on stream and another retires: the Jason-2 mission ended on 1 October 2019, after the satellite spent more than 11 years in orbit. The decision to end the mission was made due to the issues related to ageing onboard the spacecraft, experienced in recent months. Jason-3 continues to provide an excellent service – so much so, that the target availability for the service has been raised – please see slide 45.

Introduction (continued)

The availability of EUMETSAT's operational services in the reporting period was generally on target or above for all services, with the following exceptions:

- **A payload switch-off occurred on Metop-A at the end of July. A lengthy investigation showed that an SEU had disrupted the electronics. The recovery was complex and took a full 10 days before all services were back to nominal (see slides 8-9).**
- **The IODC service was impacted twice in July – once by a telecommanding error following a telemetry drop, and the second time by a Meteosat-8 payload switch-off event. See slide 8.**
- **Meteosat MPEF products for the RSS service: the product-encoding problem continued to impact RSS Regional Instability Index (RII) products until an interim solution was implemented in mid-September. See slide 10 for the latest information.**
- **Availability of RSS L1.5 data was marginally below target in December, due to a Meteosat-10 PMB safe-mode on 19 December. The anomaly signature was speedily recognized (SEU once again) and the outage was thus kept to a minimum. See slide 9.**

At the time of compilation of this report, EUMETSAT, like many other organisations, is working in a 'COVID-19 crisis mode'.

I am pleased to say that, so far, we have succeeded in maintaining nominal operational services. The next issue of this report will hopefully show continuation of that achievement in the remaining months of the half year.

Let me wish all readers safe times ahead.

Best regards,
Livio Mastroddi
Director of Operations and Services to Users

Performance Reporting: Categories

The charts on the service slides in this report present a summary view of the performance of the services within the categories listed here:

- Meteosat Services
- Metop, Suomi-NPP & NOAA Global Data Services (GDS)
- Regional Data Services (EARS)
- Search and Rescue Support
- Jason-3 OGDR Service
- Third-Party Data Services
- EUMETCast
- The EUMETSAT Data Centre
- EUMETSAT's Support to Climate Services
- Helpdesk Service

Several terms with special meaning (e.g. 'Nominal RCs') appear in the slides. A glossary is provided at the end of the report.

Performance Reporting: Conventions

This report presents an overview of EUMETSAT's operational services in the half-year reporting period by means of the following two indicators:

Service Availability:

The availability of the operational services to users is measured monthly against the maximum amount of products/data which theoretically could be delivered each calendar month of the reporting period, i.e. from a "perfect" satellite system.

Operational Performance:

This quantifies how well EUMETSAT has performed operationally with respect to its service targets, taking into account all planned outages due to special operations such as instrument calibration, decontamination and spacecraft manoeuvres, i.e. the intrinsic limitations of the satellite system.

These two indicators are used for Meteosat and Metop services as delivered over the prime dissemination mechanism, namely EUMETCast Europe. Where statistics are available, they are presented in the charts on the following slides. Comments are provided alongside, which identify any significant events or factors (satellite or ground-segment in nature) that have had impact on the service availability and/or operational performance. Currently, only product generation statistics are available for the Meteosat meteorological products.

Note: Events having significant impact on operational services are described on a dedicated slide following this one.

Events Leading To Significant Operational Impacts

Telecommand Execution Error onboard Meteosat-8, 13-14 July

A telemetry drop at the ground station during an automatic command sequence for a black-body calibration resulted in the on-ground control procedure failing and going out of step with the operation onboard. Commanding was suspended while investigation of cause was carried out, the restarted once the problem was fully understood. The quality of 28 RCs were impacted in total, by the lack of commanding to perform tank-heater switching and adjusting scanning thresholds.

IODC Service Outage due to Meteosat-8 'Payload-Off' Event, 24-29 July

The payload onboard Meteosat-8 autonomously switched off, suspected as being due to an SEU affecting a control unit, at 16:55 UTC on 24 July. The SEVIRI instrument, plus the secondary payload units (GERB, DCP and SAR) all switched off. This was the first time such an anomaly has been seen on an MSG satellite, and required a lengthy period of investigation before a recovery approach could be determined. The secondary payload units were reactivated the following day, 25 July, and the recovery of the SEVIRI commenced on the 26 July. The reactivation of SEVIRI was completed with the start of scanning at 08:45 UTC on Saturday, 27 July and once the stability of image-processing had been confirmed, the dissemination of L1.5 images was resumed at 13:45 UTC. A problem with inaccurate flight dynamics parameters caused a number of Repeat Cycles to be of non-nominal quality until refined values were calculated and the image-processing system updated. The IODC service returned to full nominal status with the resumption of the generation of Meteorological Products at 09:45 UTC on Monday, 29 July.

Metop-A Payload Switch-off on 30-July (Operational Incident 88)

The first indications of a problem onboard the satellite were autonomous mode changes of 3 payload sub-systems (IASI, MHS and NIU) all occurring simultaneously, as seen in the spacecraft telemetry shortly before 12:00 UTC on 30 July, suggesting a problem

→

Events Leading To Significant Operational Impacts (continued)

with the payload module 'BCP2' pulse. Telemetry also indicated tank-pressure readings and reaction-wheel speed of zero, pointing to the ultimate source of the problem being in the service module on the satellite platform.

Approximately 6½ hours after the first indications, a spacecraft attitude divergence triggered a reaction-wheel protection mechanism, which led to the spacecraft entering Rate Reduction Mode (RRM) with a consequent payload switch-off at 18:28 UTC, after which there was no further science data.

Investigation into the anomaly was conducted over the next few days with the support of the spacecraft manufacturer, and it was concluded that an SEU had disrupted the service module electronics.

Once the appropriate recovery strategy was determined, the quite complex recovery of the payload module was initiated. That activity was completed in the afternoon of Saturday, 3 August. Following that, the reactivation of the payload instruments was progressively undertaken, as was the resumption of the generation and dissemination of products. The last instrument (GOME-2) was returned to its nominal operational state in the afternoon of Thursday, 8 August. Dissemination of all products was fully nominal by midday on the following day.

RSS Service Outage due to a Meteosat-10 PMB safe-mode on 19 December

A PMB safe-mode occurred on Meteosat-10, which resulted in a switch-off of the payload and a swap of all platform equipment, including the Processor Module (PM), to the redundant B-side. Investigation showed that the anomaly was caused by a Single Event Transient (SET) on the voltage protection circuitry of the Switched Power Supply (SPC) of the Central Data Management Unit (CDMU). The voltage protection circuitry includes LM139 comparators, known to be susceptible to space radiation. Recovery was carried out and imaging resumed ~6.7 hours later. Nominal image quality was attained after a further 5 hours, giving a total outage of 140 RCs.

Longer-Term Factors Impacting the Operational Services

Discrete events affecting the services appear on either the previous slide (when significant) or the slide for an individual service (when affecting only that service). This slide, in contrast, lists factors of an ongoing nature.

Fuel Migration on MSG Satellites

Each MSG satellite has four fuel tanks interconnected in pairs, which allow fuel to flow along the lines between them. Under conditions of thermal stability, this movement is gradual and has negligible effect on the satellite's attitude. During eclipses, even though the tank temperature is regulated, some variation in fuel temperature and density occurs, which on Meteosat-8 and Meteosat-9 is exacerbated by the degraded thermal insulation. This gives rise to fuel migration between the tanks, causing a small resultant effect on the satellite's attitude, which manifests itself as variations in the geometric accuracy of the images. For Meteosat-8 and Meteosat-9, ground commanding is performed to partly mitigate the effect, by augmenting the satellite's onboard thermal control system to minimize the tanks' temperature variations and by timing the fuel migration to occur during scan mirror retraces. Even though the image-processing system incorporates algorithms to correct for the effects of the fuel migrations on the image quality, not all images can be corrected to achieve the target specification for geometric accuracy. Typically, around 0.4% of the RCs for the IODC service are affected, with higher rates during eclipse seasons.

Problem with BUFR Encoding of RSS RII product

The BUFR encoding of the RII (Regional Instability Index) meteorological products for the RSS service was failing due to a software processing problem that occurred with the less-cloudy skies typically seen in summer months. The processing algorithm generates data values for clear-sky segments, not for cloudy ones, and the cloud-free European weather experienced from May onwards caused processing overflows. An interim solution, which has involved reducing the geographical processing area for the product, was implemented mid-September 2019 and this will be kept in place until a permanent solution is devised and tested, now expected to be made operational in 2020/Q2.

Meteosat Services

This service category comprises the data and products produced with the Meteosat Systems.

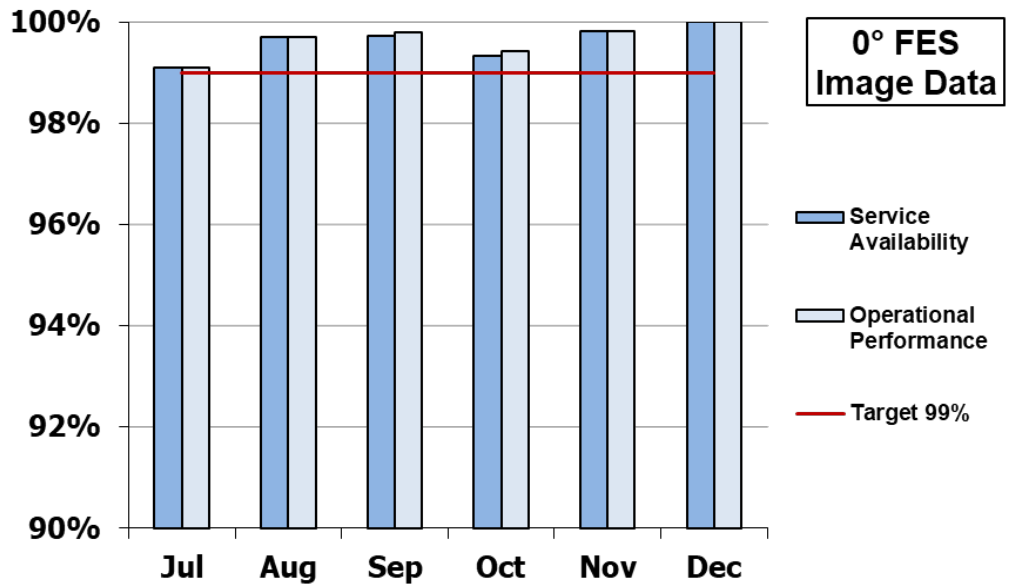
The orbital locations of and the services supported by the MSG satellites are as follows:

Meteosat-11 (at 0°):	Prime FES satellite.
Meteosat-10 (9.5°E):	Rapid-Scan Service (RSS).
Meteosat-9 (3.5°E):	Serves as the backup for the primary FES service and for RSS gap-filling.
Meteosat-8 (41.5°E):	Indian Ocean Data Coverage FES Service, on a best-effort basis.

The individual services covered by the following slides are as follows:

- Meteosat L1.5 image data and derived meteorological products for FES, RSS and IODC
- Data Collection and Retransmission (the DCP service)

Meteosat Services → 0° FES Image Data & Derived Meteorological Products

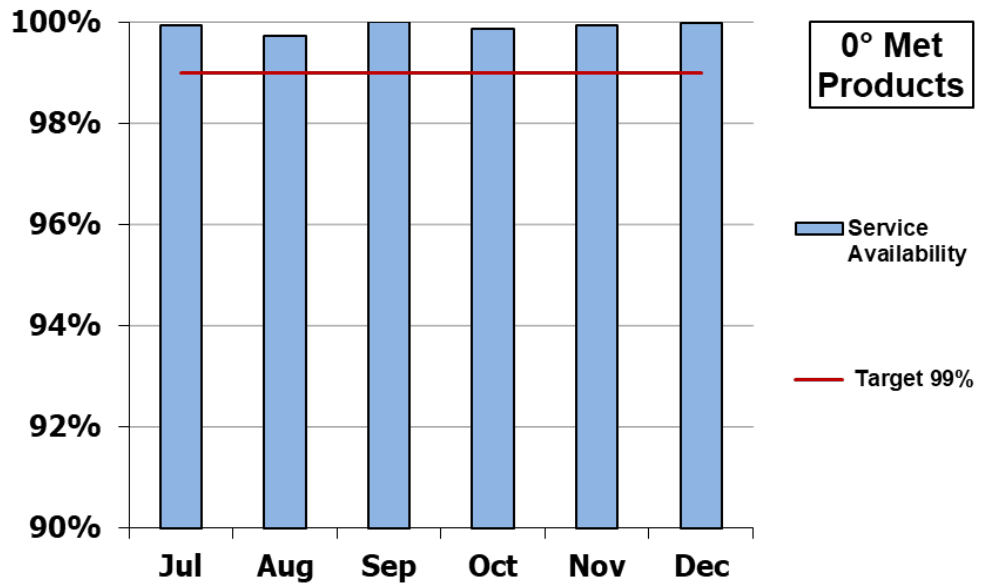


The prime satellite supporting the 0° Full-Earth Scan (FES) service is Meteosat-11.
Meteosat-9 has the role of backup.

Service Availability and Operational Performance are measured in terms of nominal Level 1.5 Repeat Cycles (RCs) disseminated 'on-time' via EUMETCast Europe. See slide 7 for an explanation of the two indicators.

Events which impacted availability:

July: 12 RCs impacted by ground segment dissemination outage on 2-July.
12 RCs impacted by tank-heater switching.



Meteorological products derived from the Full-Earth Scan (FES) images produced by the satellite supporting the 0° service.

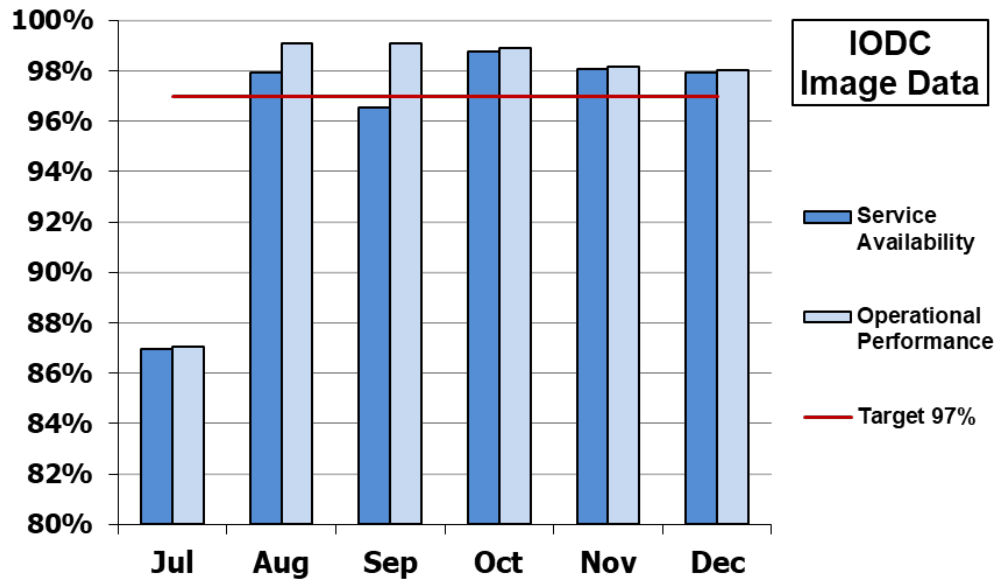
The chart shows 'end-to-end Service Availability' in terms of complete products disseminated 'on-time' via EUMETCast Europe.

Events which impacted availability:

None significant.

Note:
Dissemination of MPE products for 0° was discontinued as of 10-July-2019

Meteosat Services → 41.5°E IODC Image Data & Derived Meteorological Products

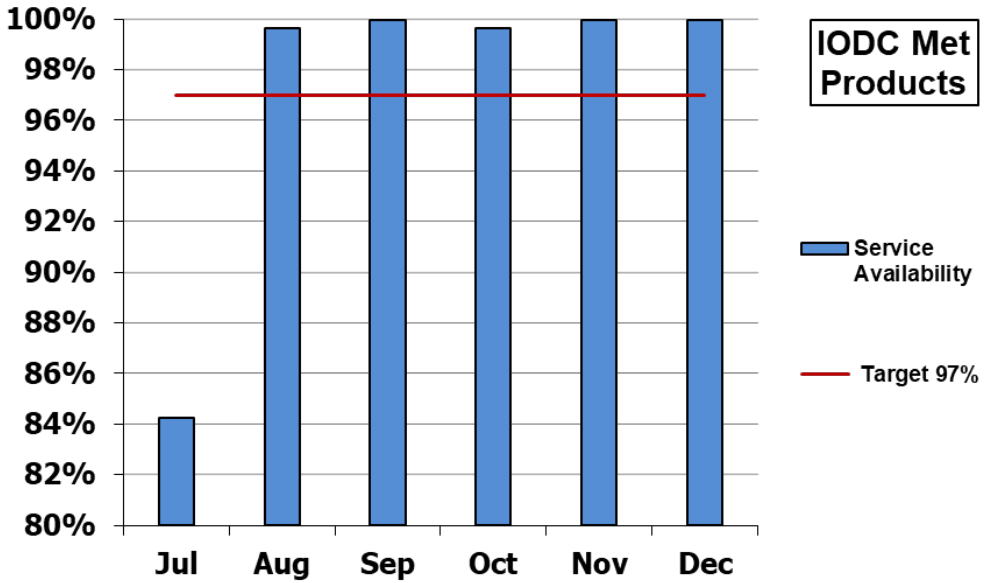


The prime satellite supporting the IODC service at 41.5°E (on a best-effort basis) is Meteosat-8. There is no backup. Service Availability and Operational Performance are measured on the basis of nominal Level 1.5 Repeat Cycles (RCs) disseminated 'on-time' via EUMETCast Europe. See slide 7 for an explanation of the two indicators.

Events which impacted availability:

2 July:	10 RCs impacted by a ground segment comms problem
13/14 July:	28 RCs impacted by a telecommand execution error (see slide 8).
24-29 July:	318 RCs impacted by Met-8 'payload off' event (also see slide 8).
Aug/Sept:	29 and 68 RCs respectively in the two months impacted by eclipse effects

Note: Due to Meteosat-8's increasing inclination, image-processing cycles can sometimes take longer and timeliness be exceeded. This was particularly noticeable in November & December.



Meteorological products derived from Full-Earth Scan images produced by Meteosat-8 at 41.5°E.

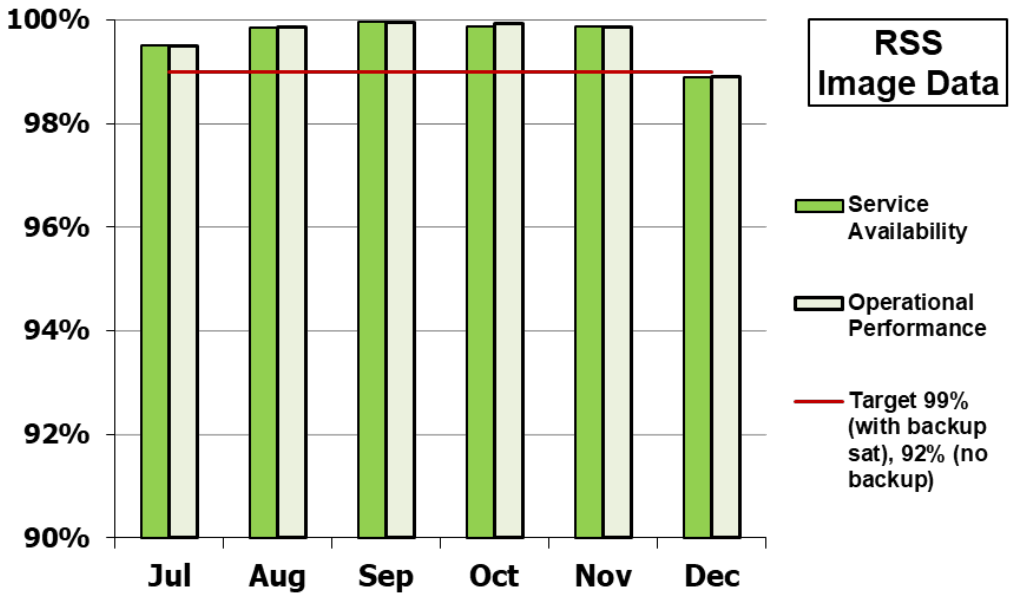
The chart shows 'end-to-end Service Availability' in terms of complete products disseminated 'on-time' via EUMETCast Europe. Note that the target availability has been raised from 98.5% to 99% for January 2019 onwards.

Events which impacted availability:

24-29 July:	No products generated / disseminated during period of Met-8 'payload off' event and recovery.

NOTE: The availability of MPE products is measured and charted separately (see slide 15).

Meteosat Services → 9.5°E RSS Image Data & Derived Meteorological Products



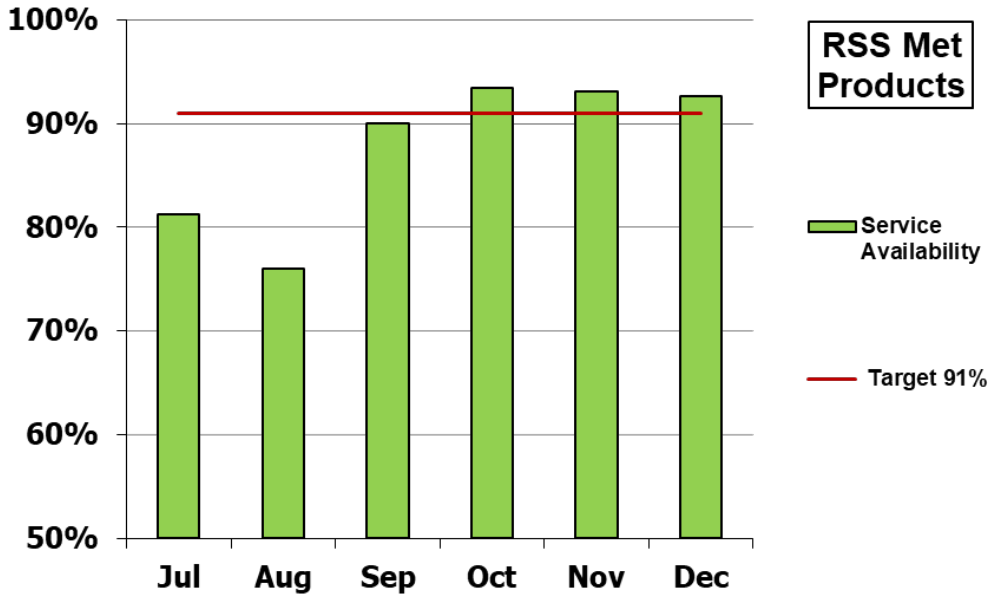
The prime satellite supporting RSS is Meteosat-10. Meteosat-9 is foreseen as a backup and is used to gap-fill when Meteosat-10's SEVIRI needs to be operated in full-scanning mode, provided it is not being used to support the 0° service, which takes priority.

For more info on RSS: www.eumetsat.int → Rapid-Scanning Service.

Service Availability and Operational Performance are measured on the basis of nominal Level 1.5 Repeat Cycles (RCs) disseminated 'on-time' via EUMETCast Europe. See slide 7 for an explanation of the two indicators.

Events which impacted availability:

19 December: A total of 140 RCs impacted by a Meteosat-10 PM-B safe-mode. The anomaly was determined to be a recurrence of a well-characterized SEU impact and thus recovery could be achieved quickly. See slide 9.



Meteorological products derived from Rapid-Scanning images produced at 9.5°E.
The chart shows 'end-to-end Service Availability' in terms of complete products disseminated 'on-time' via EUMETCast Europe.

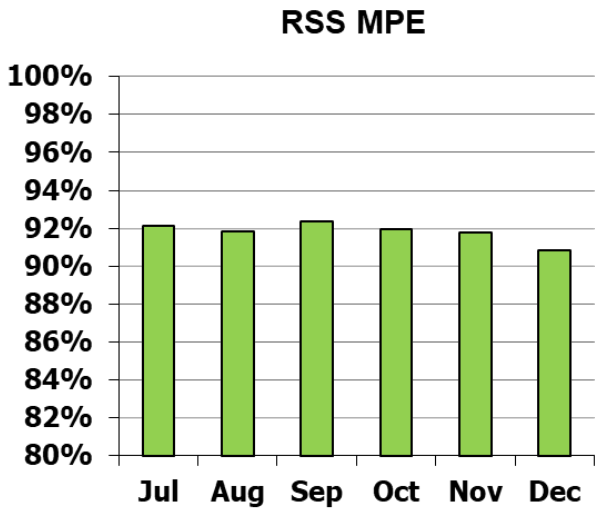
Events which impacted availability:

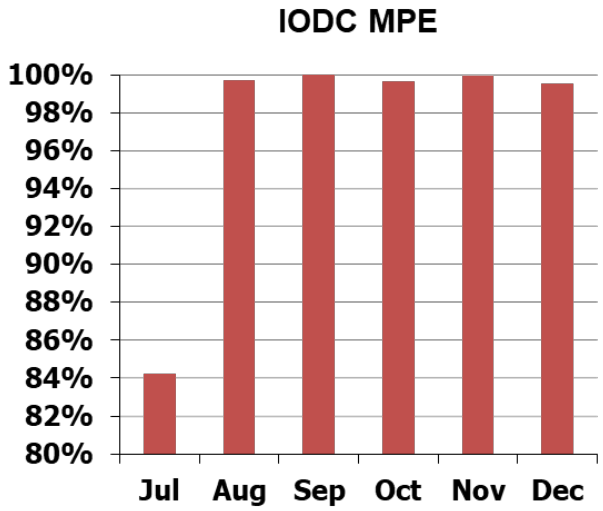
July - Sept: BUFR encoding of RII (Regional Instability Index) products failed frequently (see slide 10).

NOTES:

- 48-hour RSS pauses occur in a 28-day cycle and an annual 28-day pause typically occurs in the winter months - the next annual pause is planned for Jan-Feb 2020.
- See slide 15 for the availability of RSS MPE products.

Meteosat Services → MPE Products for the RSS and IODC Services





Multi-sensor Precipitation Estimate (MPE) products are derived from infrared data in Meteosat RSS and IODC imagery, and passive microwave imager data from the US DoD's DMSP satellites. MPE products are used for nowcasting and short-term forecasting, especially useful for regions for which there is no rainfall radar data, such as in Africa and Asia. Availability of MPE products is measured in terms of the number of products disseminated via EUMETCast, as a percentage of those scheduled.

Events which impacted availability:

24-29 July: Meteosat-8 payload switch-off resulted in a total of 113 hours of non-availability of IODC MPE products (see slide 8 for more information).

Notes:

- **The availability of MPE products is presented separately, to take account of their being derived from data from the US DoD's DMSP satellites, the availability of which is beyond EUMETSAT's control and provided by aging instruments.**
- **RSS Service availability reflects the RSS pauses, in which no met. products are produced.**
- **The dissemination of MPE products derived from 0° imagery data was discontinued as of 10-July-2019.**

Meteosat Services → DCP Channel Availability at 0°

Data Collection and Retransmission operations at 0° utilise the international and regional DCP channels of the satellite supporting the service (nominally Meteosat-11).

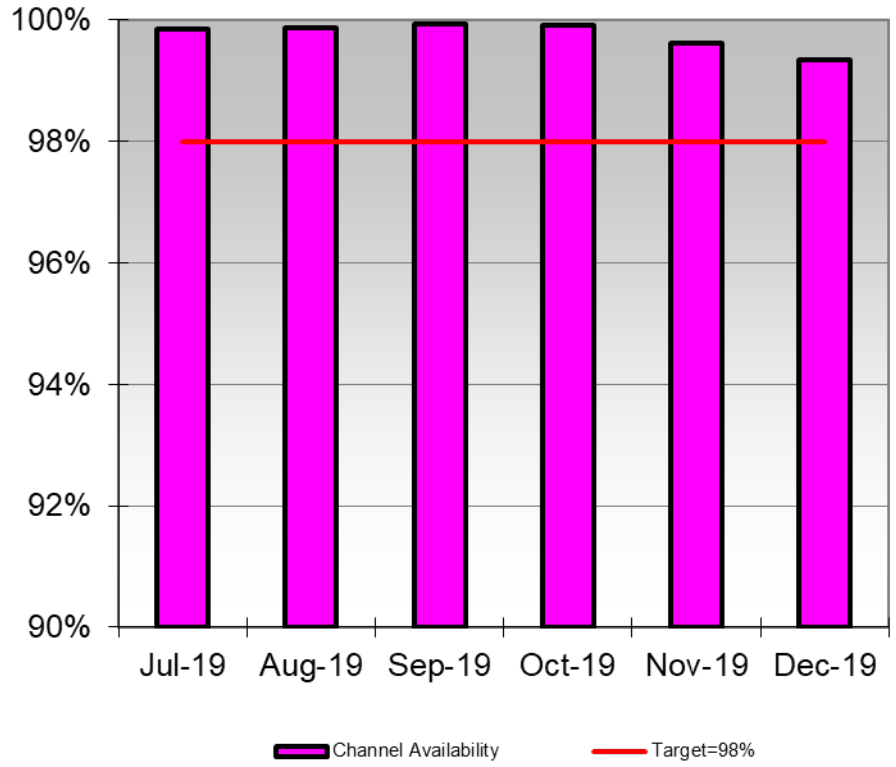
The chart shows the availability of the 0° DCP service. It is measured in terms of the number of hourly reference DCP messages on all operational regional channels which have been successfully received back by EUMETSAT, as a percentage of those sent.

For information concerning the geographical distribution of registered DCPs, please see the next slide.

<u>Events which impacted DCP Channel Availability:</u>

None significant.

<u>Note:</u> Some DCP messages continue to be corrupted/lost due to interference on the satellite link. It is not expected that the cause will be resolvable. EUMETSAT continues to monitor the situation.



Meteosat Services → Geographical Distribution of DCPs as of 31 December 2019

DCPs	Country	DCPs	Country	DCPs	Country	DCPs	Country
6	Albania	1	Falklands	1	Malta	10	Tanzania
51	Algeria	1	Finland	4	Mauritania	2	Togo
13	Angola	134	France	4	Mauritius	70	Uganda
2	Armenia	1	Gambia	23	Mozambique	52	UK
1	Austria	27	Germany	29	Namibia	24	Ukraine
6	Belarus	13	Ghana	17	Niger	1	Union des Comores
2	Benin	1	Gibraltar	108	Nigeria	67 ↑	USA
5	Bhutan	1	Greece	10	Oman	1	Yemen
14	Botswana	11	Guinea	4	Pakistan	16	Zambia
1	Brazil	2	Guinea-Bissau	3	Philippines	13	Zimbabwe
1	Bulgaria	9	Indonesia	11	Republic of Moldova		
7	Burkina Faso	2	Iran	9	Republic of Seychelles		
60	Cameroon	200	Iraq	7	Romania		
2	Canada	8	Ireland	8	Rwanda		
4	Cap Verde	74	Italy	11	Senegal		
2	Central African Republic	3	Ivory Coast	13	Sierra Leone		
3	Chad	3	Kenya	1	Slovakia		
3	Congo	6	Lesotho	41	South Africa		
		11	Libya	8	Spain		
1	Cyprus	6	Madagascar	148	Sri Lanka		
51	Dem. Rep. of the Congo	9	Malawi	3	Sudan		
8	Djibouti	3	Maldives	5	Southern Sudan		
1	Egypt	19	Mali				

Larger numbers of DCPs are highlighted with darker colours.

Table entries in green = new; Country name in red = DCPs no longer registered.

↑↓ = indicates an increase /decrease in DCPs registered, compared with previous report.

As of the end of December 2019, there were:

1,513 registered Data Collection Platforms, belonging to 136 DCP operators, deployed by the 77 countries shown in the table.

Of the total number of registered DCPs, there were 442 units in active operation.

Metop, Suomi-NPP & NOAA Global Data Services (GDS)

These services refer to the dissemination of global data and products produced as part of the Initial Joint Polar System (IJPS) and the Joint Transition Activities (JTA) agreements between EUMETSAT and NOAA. The JTA is an interim agreement, providing continuity between the Initial Joint Polar System (IJPS) and future Joint Polar System (JPS).

The services provide Level 0, 1 and 2 products derived from the data from the instruments onboard the 3 Metop satellites (Metop-C since July 2019), Suomi-NPP and NOAA-19, as summarised in the following table:

	A-DCS	AMSU	ASCAT	ATOVS	AVHRR	GOME-2	GRAS	HIRS	IASI	MHS	SEM	ATMS & CrIS
Level 0	ABC (1)	-	-	-	-	-	-	-	-	-	ABC	-
Level 1	-	ABC, N	ABC	-	ABC, N	ABC (2)	ABC	AB, N	ABC	ABC, N	-	S
Level 2	-	-	-	B (3), N	-	-	-	-	ABC	-	-	-

Legend: '**A', 'B' and 'C**' = Indicates products extracted from the data from the Metop-A, Metop-B (prime) and Metop-C (secondary) satellites, respectively.

Note the following exceptions:

(1) Reduced capability of A-DCS on Metop-B, i.e. only Argos-2 mode.

(2) GOME-2 Trident operations: Metop-A instrument has swath width of 960 km, Metop-B and C have full width of 1920 km.

(3) ATOVS L2 products only for Metop-B (further info – see ATOVS slide)

'**N**' = Level 1 products from the AMSU, AVHRR, HIRS and MHS instruments onboard NOAA-19, and ATOVS.

'**S**' = Sensor Data Records for the ATMS and CrIS instruments onboard Suomi-NPP.

The following slides show the monthly availability of the products, identifying any significant events which impacted the service.

Metop, Suomi-NPP & NOAA GDS: Definition of Availability

Unless otherwise indicated in the availability slides, the monthly figures are those for 'timely availability', where 'timely' is used to mean the following:

Levels 0 & 1:	Available within 2 hours 15 minutes of sensing (Metop and NOAA)
Level 2:	Available within 3 hours of sensing (Metop and NOAA)
SDRs:	Available within 2 hours of sensing (Suomi-NPP)

The above timeliness targets are those originally specified for the Metop and NOAA-19 data and delivery is currently measured against them. The Level 0 and 1 targets for the primary Metop are by far exceeded since the introduction of (1) the Antarctic Data Acquisition (ADA) service which improved the timeliness of the data, and (2) the multiplexed data transfer between the Svalbard Ground Station and Darmstadt which gave a further timeliness improvement for the data of all 3 Metops.

Availability figures are based on the following:

Level 0:	Production statistics from EUMETSAT's EPS Product Generation Facility
Levels 1 & 2:	Reception statistics from EUMETSAT's reference EUMETCast User Station

The next slide shows the profile of Metop-B passes acquired via the ADA service, which relays half-orbits'-worth of data for most of the 14 to 15 passes possible per day, delivering the first half of each orbit approximately 50 minutes earlier than that via Svalbard.

On slide 21 onwards, service availability and operational performance are presented for the data (mostly delivering Level 1) from instruments onboard the 3 Metops, NOAA 19 and Suomi-NPP. Please see slide 7 For explanation of the two metrics.

Note: Metop-C data was added to the service as of 3 July 2019 onwards.

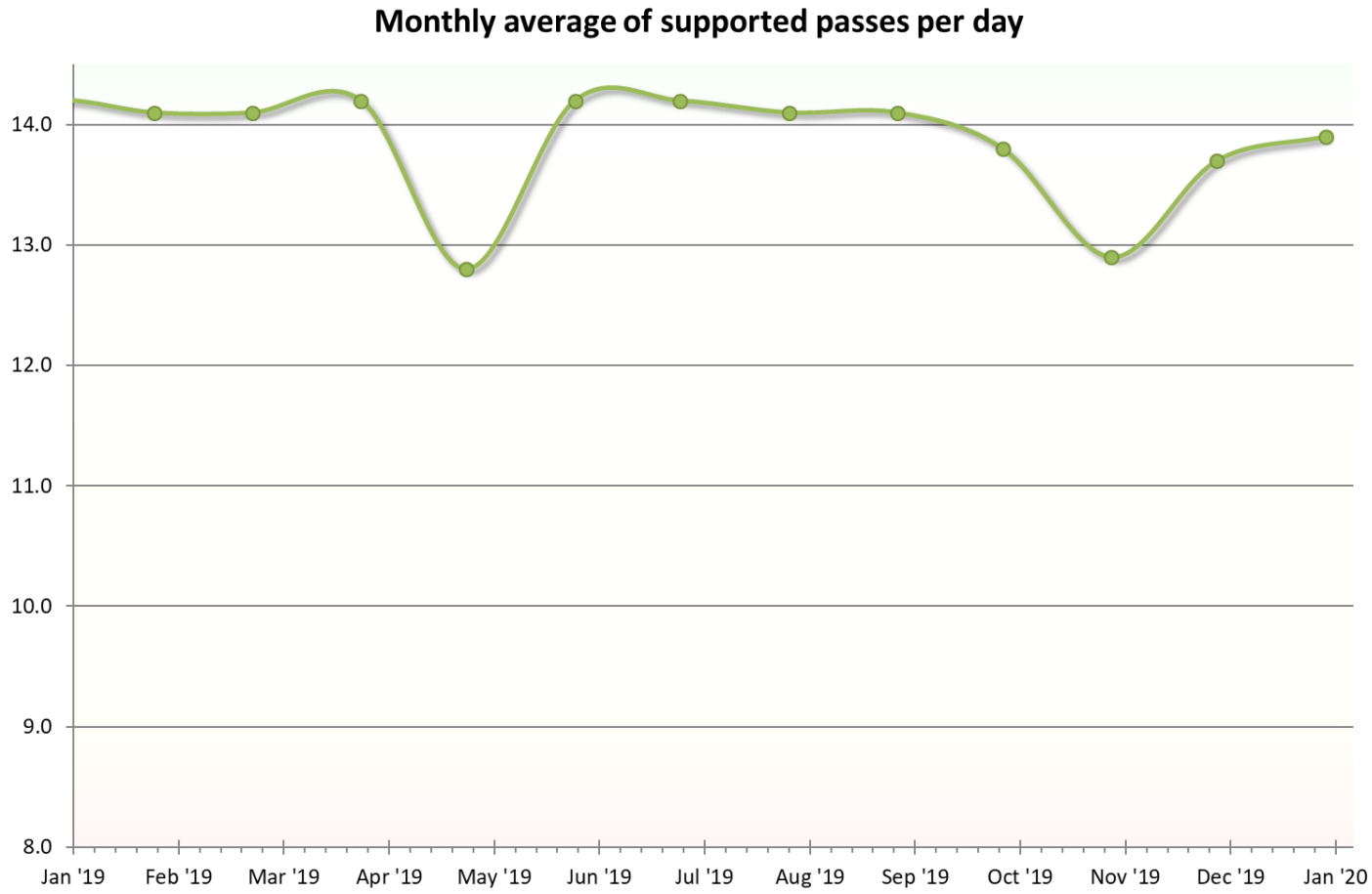
Metop, Suomi-NPP & NOAA GDS: Antarctic Data Acquisition (ADA)

Data from the primary Metop satellite, Metop-B, is acquired at NOAA-NSF's ground station on McMurdo Sound in Antarctica and routed to EUMETSAT HQ. This acquisition complements that of Svalbard, and allows the data of the first half of each orbit to be processed and disseminated earlier, thus improving data timeliness of Metop-based products.

The chart shows the average daily passes per month that have been successfully acquired at McMurdo and relayed to Darmstadt in the last 12 months.

Maximum average orbits / day possible = 14.2

The overall daily average of supported passes in the 12 months shown on chart = 13.9



Events in the reporting period:

November: Network fibre connectivity problem impacted the ability to control the antenna and thus acquire downlink. 6 orbits lost 15-16 Nov, and 19 orbits lost 22-24 Nov.

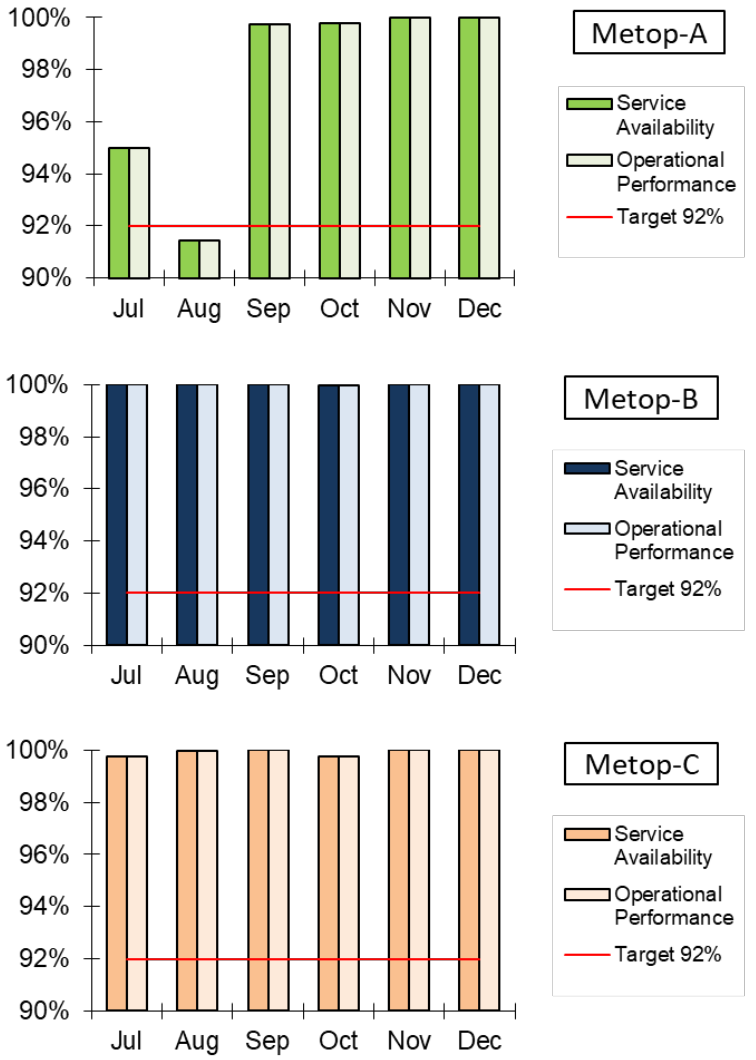
Metop, Suomi-NPP & NOAA GDS → A-DCS Level 0 Data

The Metop satellites carry instruments for supporting the Argos Advanced Data Collection System (A-DCS). Environmental data is transmitted by measurement platforms on land or sea, or in the atmosphere, and this is relayed via the Metop satellites and EUMETSAT to CLS in Toulouse, in accordance with a cooperation agreement with CNES.

Metop-A provides the prime Argos-3 A-DCS service, Metop-B just Argos-2 mode (due to the reduced capability of A-DCS onboard that satellite), and Metop-C supports Argos-3.

Events which impacted availability:

30 July – 3-August: Metop-A payload switch-off (Incident 88 – see slides 8-9)



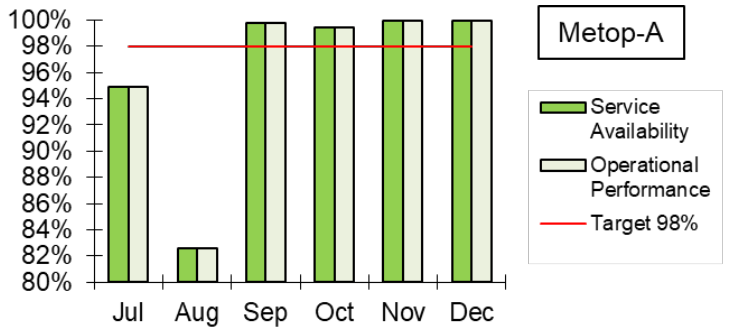
Metop, Suomi-NPP & NOAA GDS → AMSU Level 1B BUFR Products

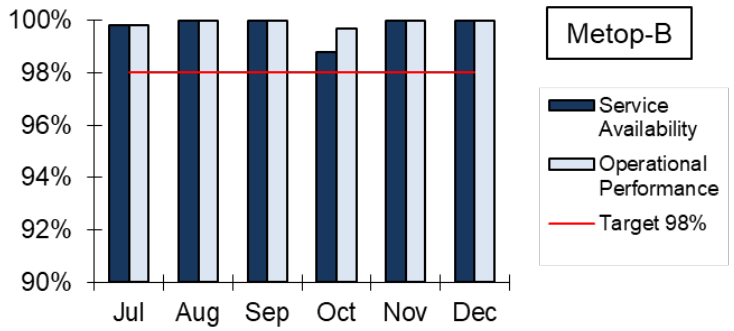
The Advanced Microwave Sounding Unit (AMSU) is a 15-channel microwave radiometer supplied by NOAA which provides information on atmospheric temperature profiles.

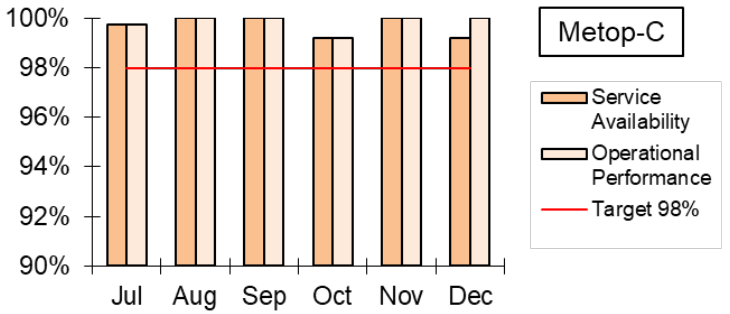
Level 1B products are derived from the data generated by the instruments onboard the 3 Metop satellites and also NOAA-19.

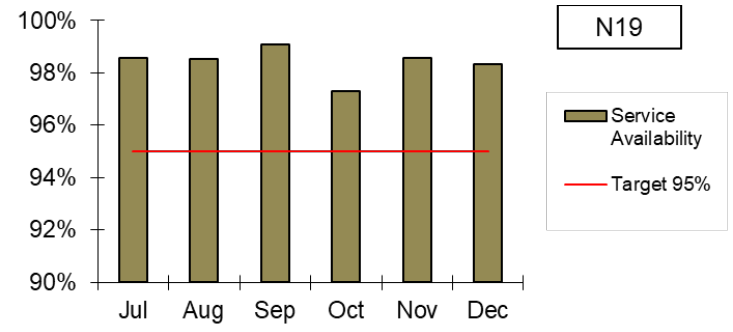
Events which impacted availability:

30 July – 3-Aug:	Metop-A payload switch-off (Incident 88 –see slides 8-9)
16 October:	Metop-B out-of-plane manoeuvre
4 December:	Metop-C out-of-plane manoeuvre









Notes:

(1) Metop-A AMSU: channels 7 & 8 have failed completely; channel 3 continues to degrade, but the remaining 12 channels remain in spec and are fully usable.

(2) Metop-B AMSU: channel 15 has failed completely; channel 7 still exhibiting transient spikes and channel 3 is degrading and close to specifications.

(3) NOAA-19 AMSU: channels 7 & 8: out of specification but the data is still considered usable for the time-being

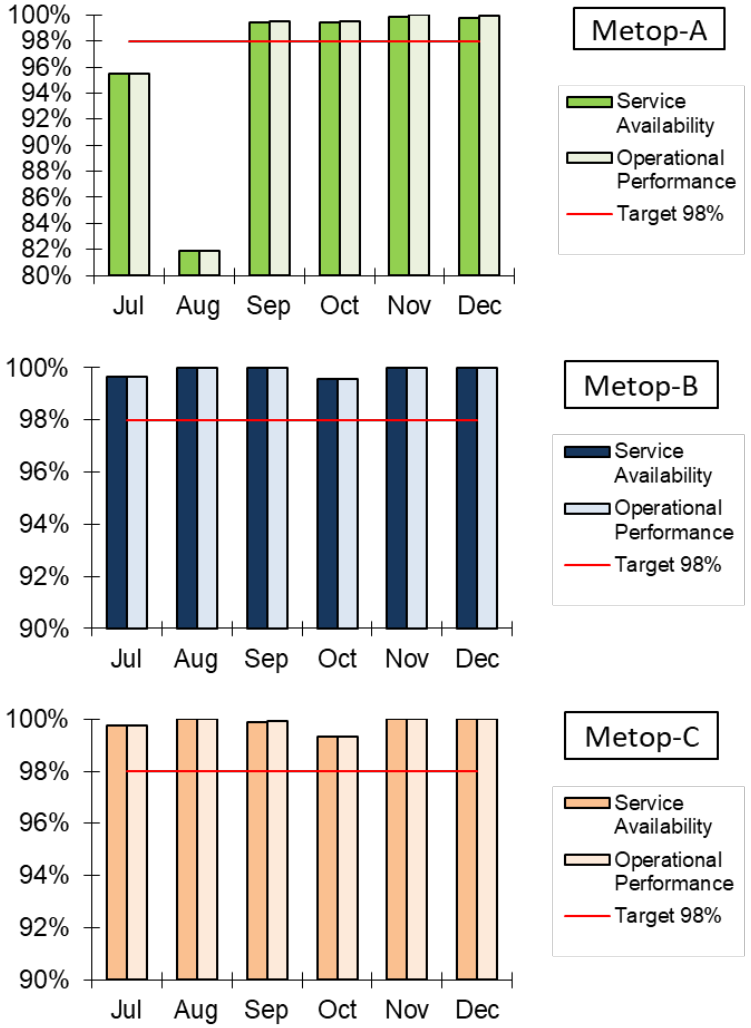
Metop, Suomi-NPP & NOAA GDS → ASCAT Level 1B (SZF) Products

The Advanced Scatterometer (ASCAT) is a C-band radar on the Metop satellites which measures normalised backscatter from the Earth's surface. The prime objective of ASCAT is to measure wind speed and direction over the oceans, as an input to NWP models. ASCAT data is also used to extract information on soil moisture, sea-ice extent and permafrost boundary. EUMETSAT disseminates sampled Level 1B data and derived Level 2 products over EUMETCast.

Performance of the Level 1B service is measured in terms of the timely availability of the 'SZF' products (full resolution - original instrument sampling) on the EUMETCast reference user station.

Events which impacted availability:

30 July – 3-Aug: Metop-A payload switch-off (Incident 88 – see slides 8-9)



Metop, Suomi-NPP & NOAA GDS → ATOVS Level 2 Products

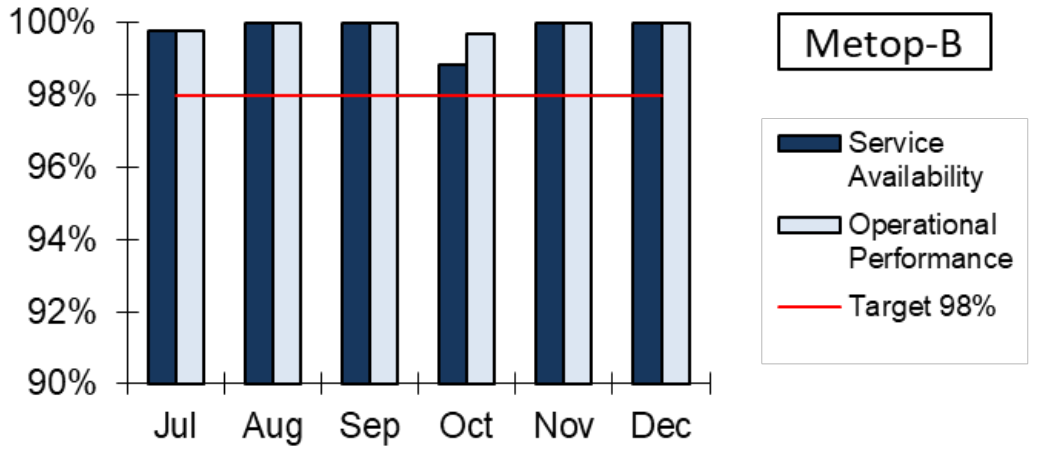
ATOVS Level 2 product processing transforms the calibrated radiance measurements from the AMSU-A, MHS and HIRS instruments (onboard Metop-B and NOAA-19 satellites) into information on the vertical distribution of atmosphere state parameters, on cloud and surface parameters and total atmosphere contents. All the parameters derived are assembled into one ATOVS L2 sounding product for each satellite.

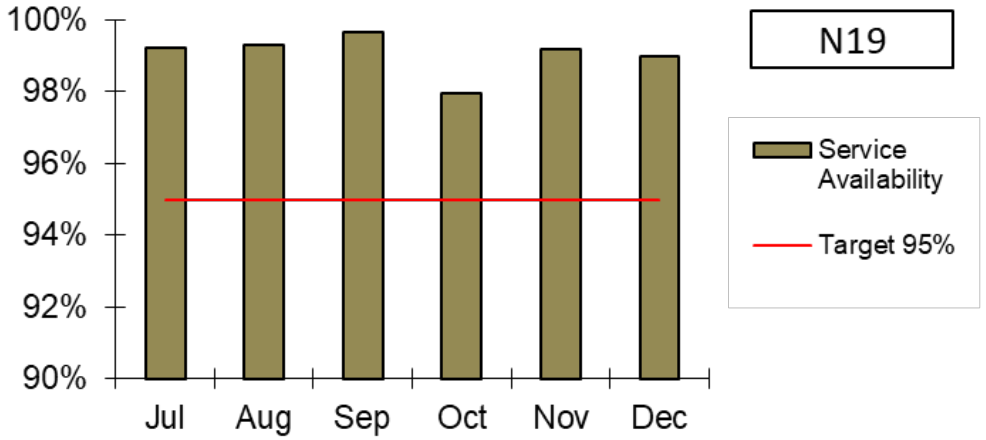
Performance of the Level 2 service is measured in terms of the timely availability of the BUFR-encoded products received on the EUMETCast reference user station (US).

Events which impacted availability:

16 October: Metop-B out-of-plane manoeuvre

Note: Metop-A ATOVS L2 products were discontinued as of 7 December 2015, due to the failure of channels 7 and 8 of the AMSU instrument on that satellite. Metop-C does not host a HIRS instrument.





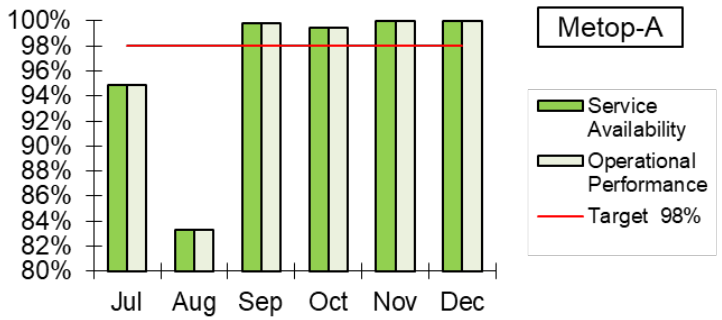
Metop, Suomi-NPP & NOAA GDS → AVHRR Level 1B Products

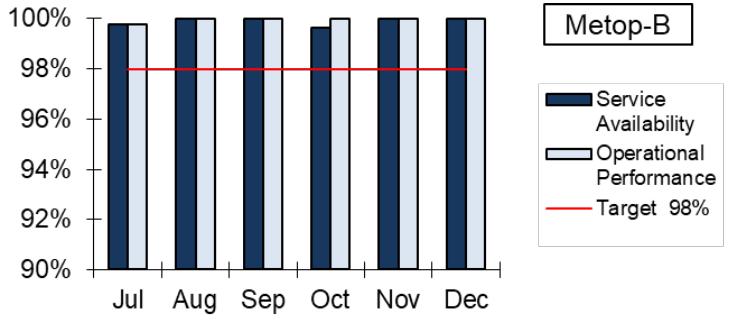
The Advanced Very High Resolution Radiometer (AVHRR) is a multi-spectral imaging instrument provided by NOAA which produces global cloud imagery and information on land and sea surfaces. Level 1B products are derived from the data generated by the instruments onboard the Metop and NOAA-19 satellites.

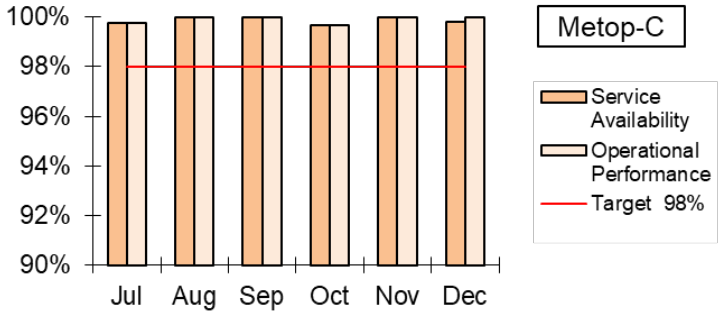
Events which impacted availability:

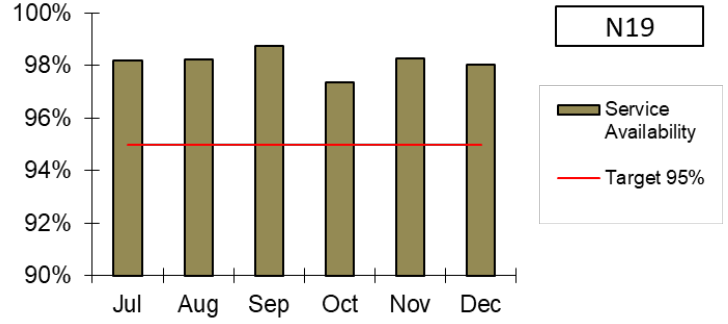
30 July – 3-Aug: Metop-A payload switch-off (Incident 88 – see slides 8-9)

16 October: Metop-B out-of-plane manoeuvre







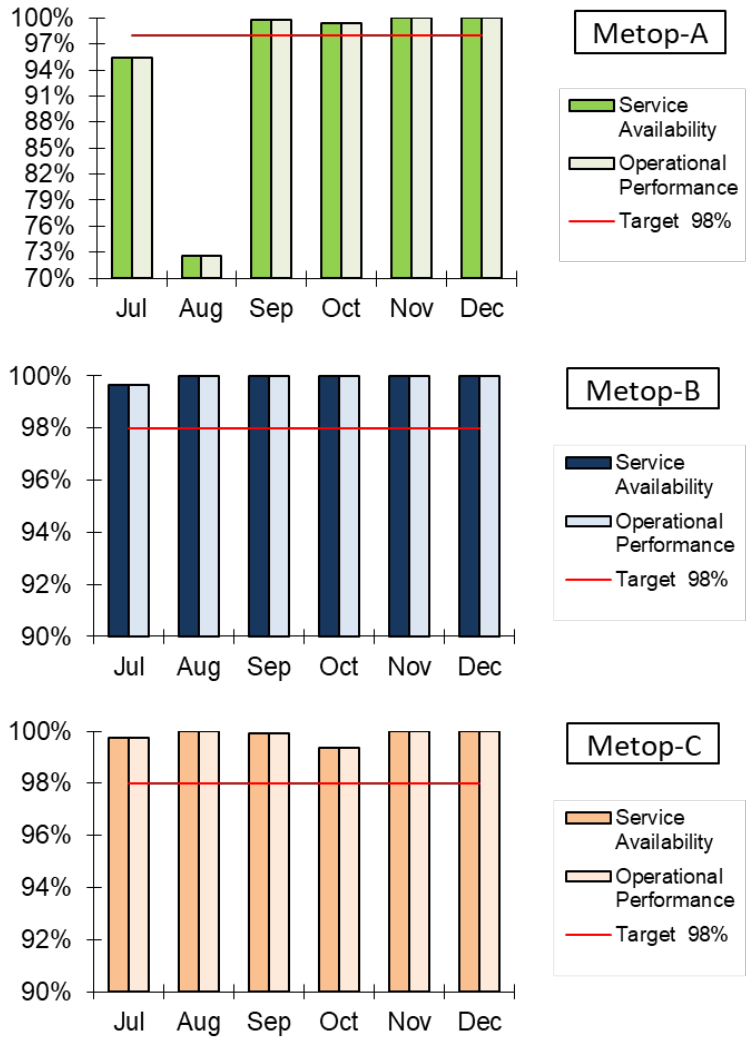


Metop, Suomi-NPP & NOAA GDS → GOME-2 Level 1B Products

The Global Ozone Monitoring Experiment-2 (GOME-2) is a scanning spectrometer used to measure profiles and total columns of atmospheric ozone and other trace gases. There is an instrument onboard each of the Metop satellites.

Events which impacted availability:

30 July – 3-Aug: Metop-A payload switch-off (Incident 88 – see slides 8-9)



GOME-2 on Metop-B suffers degradation of throughput which is similar, but not identical, to that seen on Metop-A. GOME-2 on Metop-C has been performing well since the beginning of the mission in November 2018.
The performance of the GOME-2 instruments on all three satellites and the evolution of any degradation are continually monitored.

See the 'Product Quality Monitoring Reports' via dedicated links in the Metop section on the 'Service Status' page of www.eumetsat.int for further performance information. Links to the GOME-2 Newsletter can be found in the reports.

Metop, Suomi-NPP & NOAA GDS → GRAS Level 1B Products

The GNSS Receiver for Atmospheric Sounding (GRAS) instruments provide information on atmospheric profiles using radio occultation of GPS signals from typically between 28 and 31 GPS navigation satellites in operational use.

The chart shows for each month:

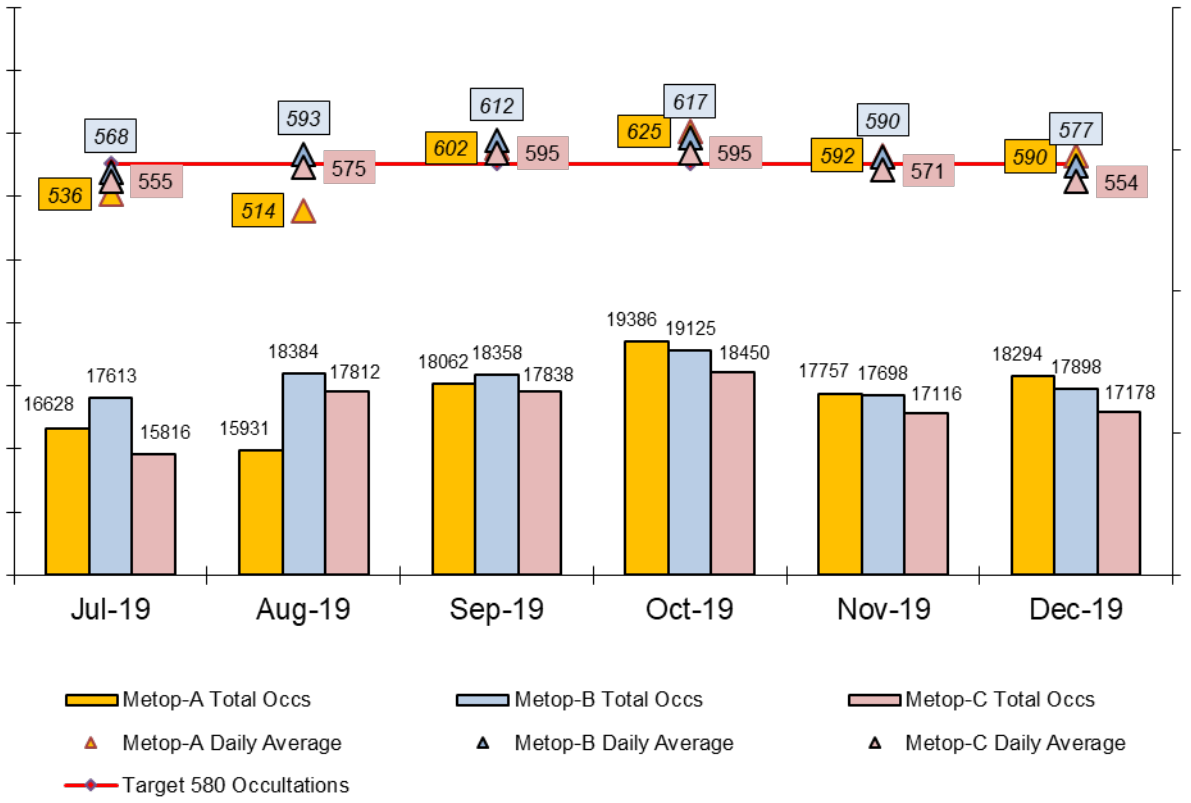
(1) the total numbers of GRAS Level 1B occultations (plus geolocation and quality flags) from the 3 Metop satellites disseminated via EUMETCast

(2) the daily average number of occultations from each Metop provided to users (numbers in italics)

Note that all occultations produced are disseminated, along with appropriate quality flags (including those produced during manoeuvres and recovery from anomalies).

Events which impacted availability:

30 July – 3-Aug: Metop-A payload switch-off (Incident 88 – see slides 8-9)



Note: The number of occultations is dependent on the number of GPS navigation satellites in view but also on various orbital factors.

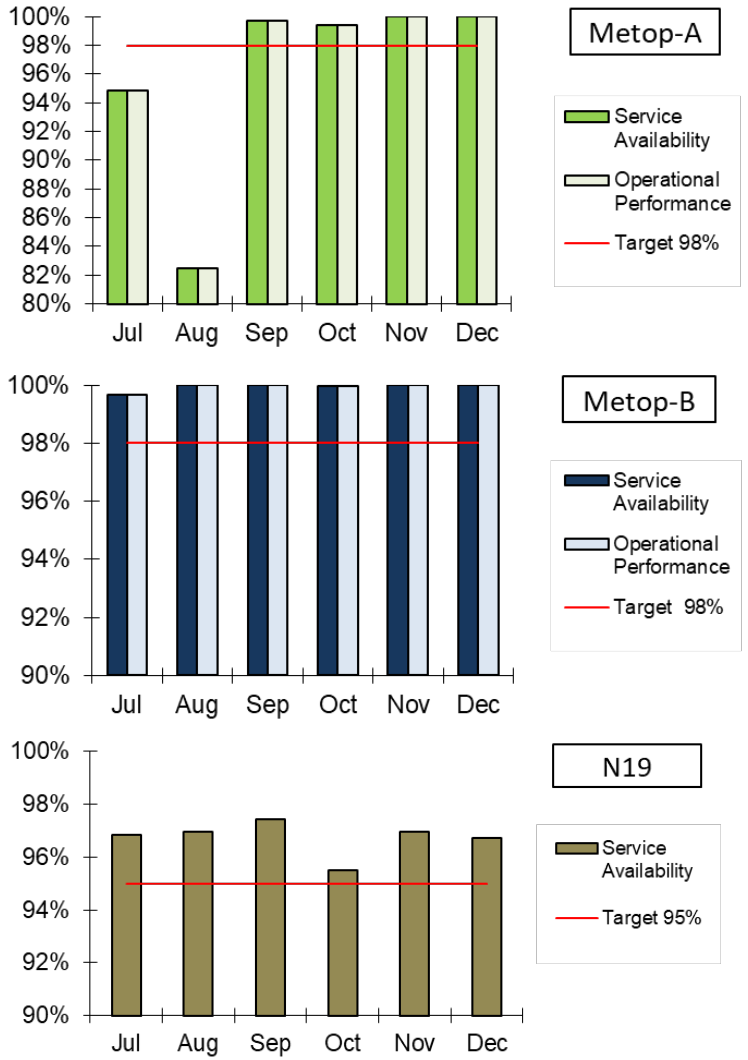
Metop, Suomi-NPP & NOAA GDS → HIRS Level 1B BUFR Products

The High Resolution Infrared Radiation Sounder (HIRS) measures incident radiation using 19 infrared channels and 1 visible channel, providing information on the atmosphere's vertical temperature profile and water vapour from the Earth's surface to an altitude of about 40 km. Level 1B products are derived from the data generated by the instruments onboard the Metop-A, Metop-B and NOAA-19 satellites (no HIRS on Metop-C).

As can be seen from the note below, the instrument onboard Metop-A is suffering from 'old age', with data quite degraded.

Events which impacted availability:

30 July – 3-Aug: Metop-A payload switch-off (Incident 88 – see slides 8-9)



Notes on latest instrument status:

(1) **Metop-A HIRS: channels 1-19 out of spec, with large, short-term fluctuations and further degradation likely.**

(2) **Metop-B HIRS: channels 5, 6, 10 and 14 slightly out of spec; instrument radiometric performance quite stable over the reporting period.**

(3) **NOAA-19 HIRS: channels 1-12: close to, or out of specification, but the data is still considered usable for the time-being.**

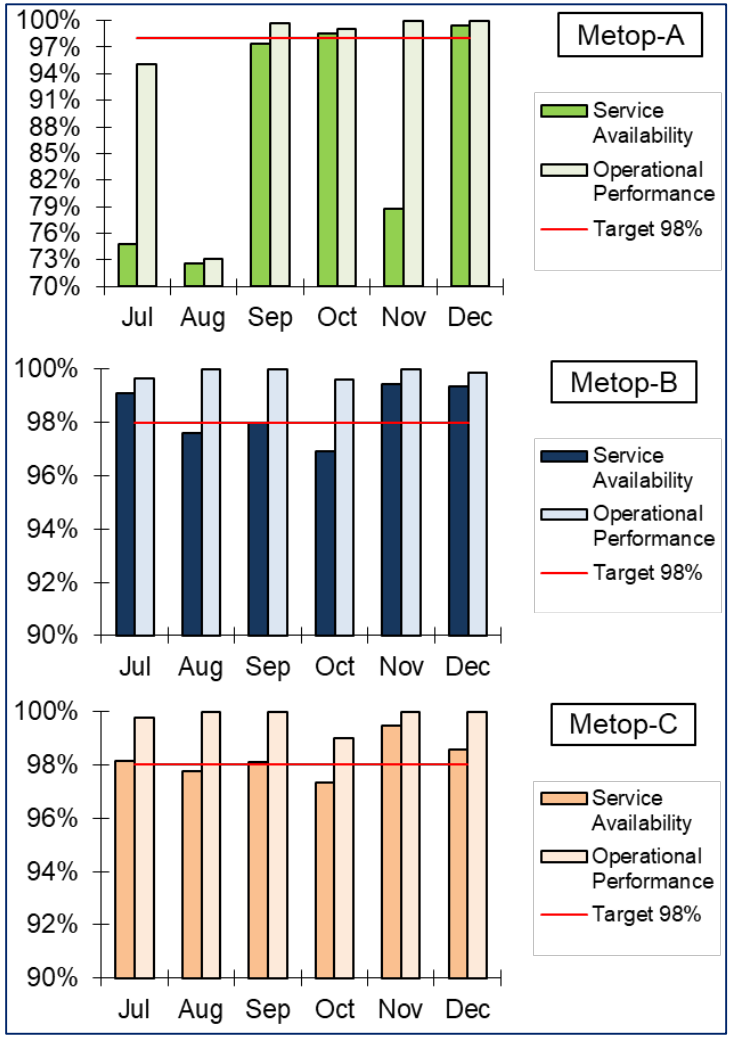
Metop, Suomi-NPP & NOAA GDS → IASI Level 1C & Level 2 BUFR Products

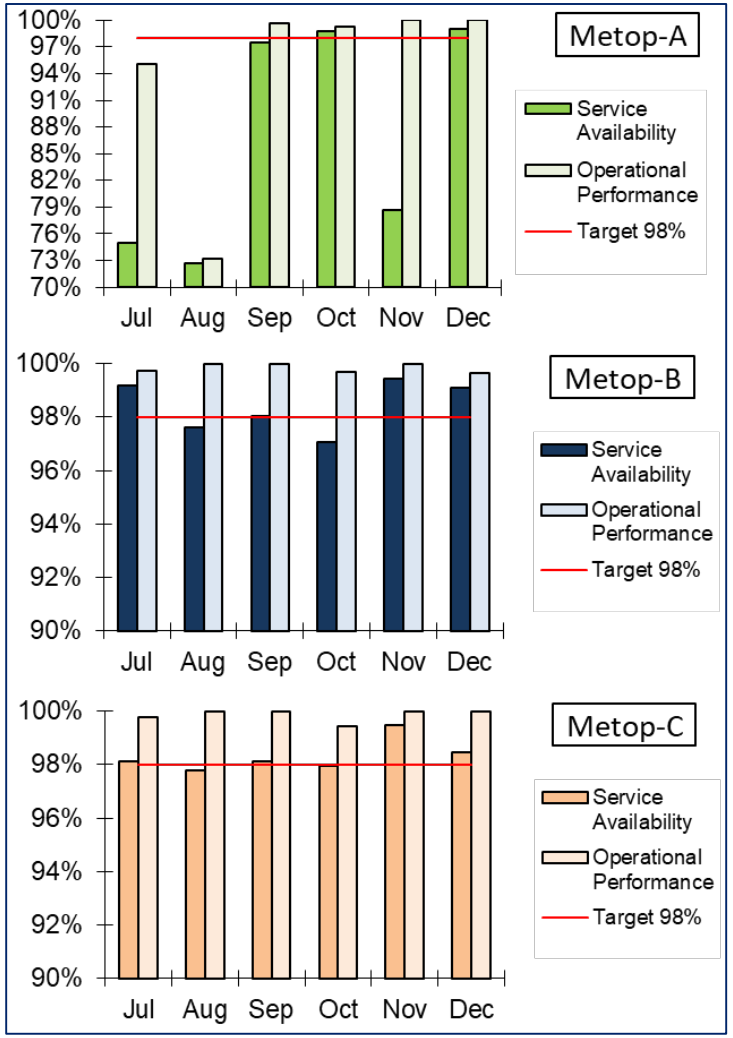
The Infrared Atmospheric Sounding Interferometer (IASI) measures the spectrum of infrared radiation in 6000 channels, providing information on atmospheric profiles of temperature, water vapour and trace gases, as well as surface temperature, surface emissivity and cloud characteristics.

Events which impacted availability:

30 July – 3-Aug:	**Metop-A payload switch-off (Incident 88 – see slides 8-9)**
July - October:	**Metop-C extensive calibration**
Aug - October:	**Metop-B extensive calibration**
16 October:	**Metop-B out-of-plane manoeuvre**
12-18 November:	**Metop-A onboard software update activity**
4 December:	**Metop-C out-of-plane manoeuvre**

Note that external calibrations are performed typically on a monthly basis and these reduce the availability of Level 1 / Level 2 data (relative to that of Level 0) by approximately 0.5 to 0.6% of the scheduled availability.





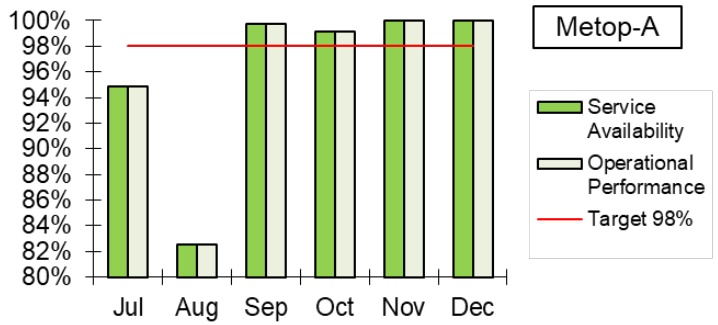
Metop, Suomi-NPP & NOAA GDS → MHS Level 1B BUFR Products

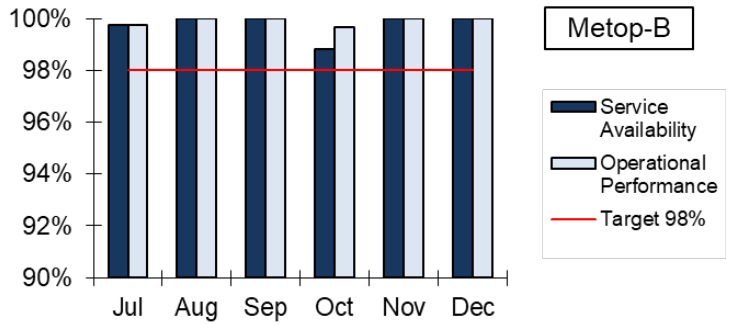
The Microwave Humidity Sounder (MHS) is a 5-channel microwave radiometer providing information on atmospheric humidity profiles primarily, but also cloud liquid water content and precipitation.

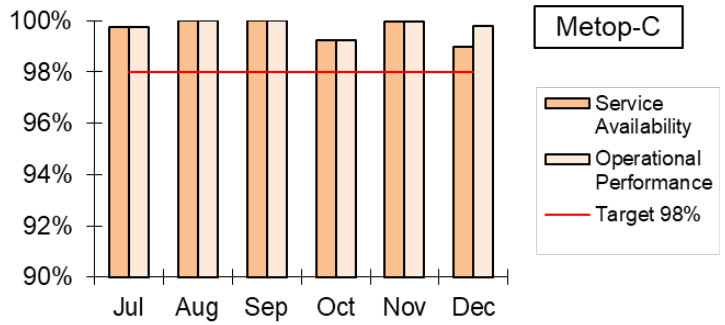
Level 1B products are derived from the data generated by the instruments onboard the 3 Metop satellites and NOAA-19.

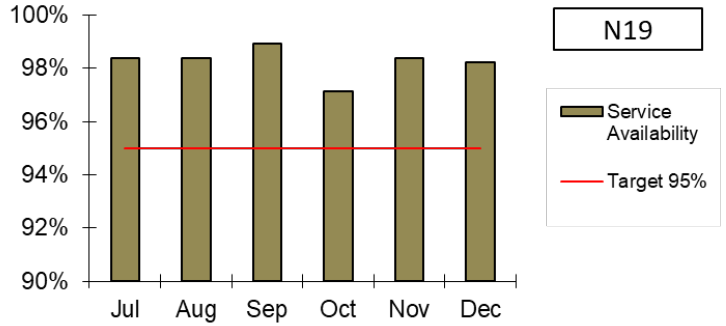
Events which impacted availability:

30 July – 3-Aug:	**Metop-A payload switch-off (Incident 88 – see slides 8-9)**
16 October:	**Metop-B out-of-plane manoeuvre**
4 December:	**Metop-C out-of-plane manoeuvre**









Notes on latest instrument status:

- **NOAA-19 MHS: channel 3 remains out of spec.**
- **Metop-A MHS: channel 2 out of spec since 15-April-2019 with a trend of further degradation.**
- **Metop-B MHS: all channels within spec.**

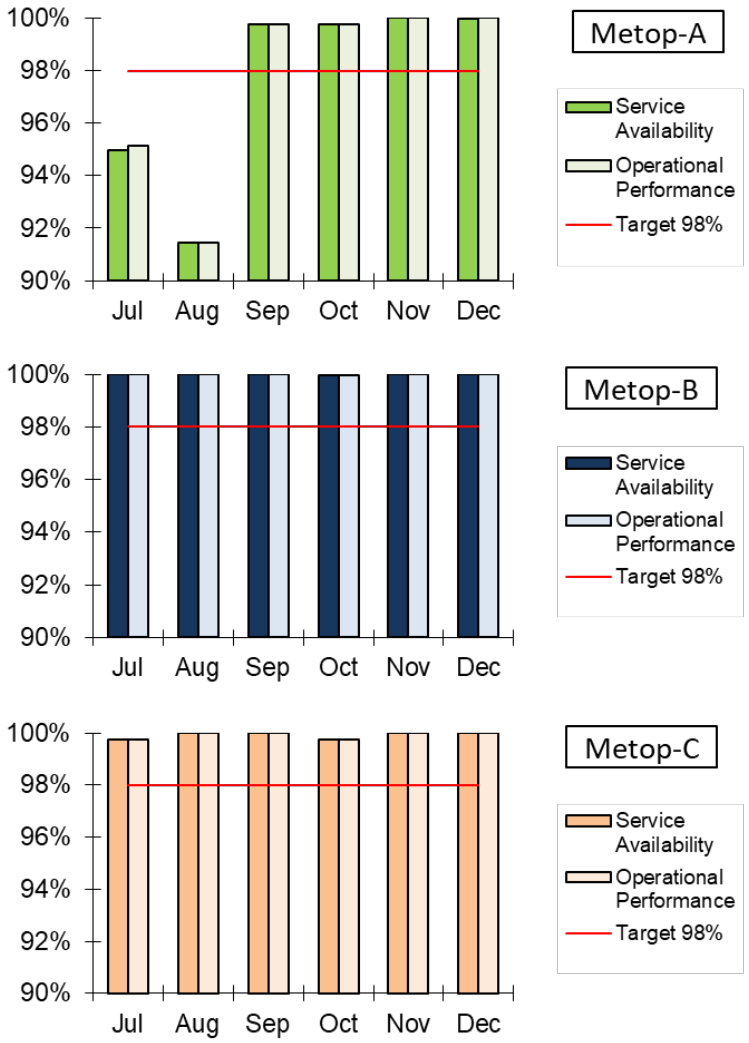
Metop, Suomi-NPP & NOAA GDS → SEM Level 0 Data

The Space Environment Monitor (SEM) consists of a pair of instruments on each Metop satellite which provide data to determine the intensity of the Earth's radiation belts and the flux of charged particles at the satellite's orbiting altitude.

Level 0 data (consisting of the SEM instrument source packets in EPS native format) is provided to NOAA via a dedicated terrestrial line.

Events which impacted availability:

30 July – 3-Aug: Metop-A payload switch-off (Incident 88 – see slides 8-9)

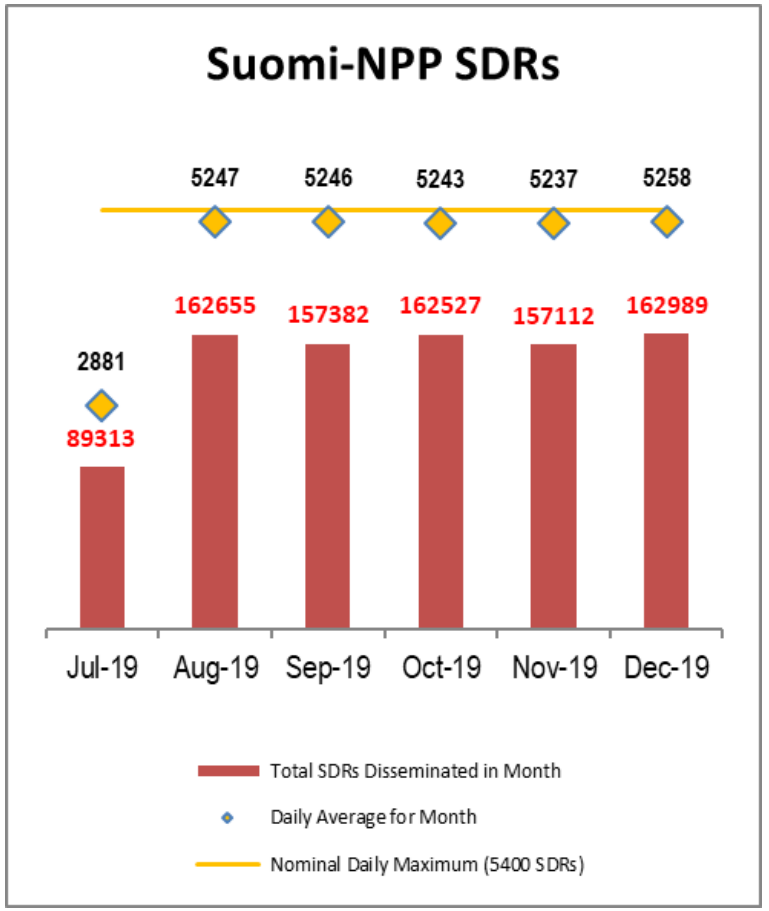


Metop, Suomi-NPP & NOAA GDS → Suomi-NPP Sensor Data Records

The Global Data Service delivers Sensor Data Records from the ATMS and CrIS instruments (Advanced Technology Microwave Sounder and Cross-track Infrared Sounder respectively) onboard NASA-NOAA's Suomi-NPP (National Polar-orbiting Partnership) satellite.

Events which impacted availability:

1-29 July: **Planned outage for CrIS instrument maintenance, needed for recovering from the midwave signal processor failure (activity continued from 26 June)**



Regional Data Services

The Regional Data Services (RDS) are based on direct acquisition of data from Metop and NOAA satellites by a network of HRPT stations, known as EARS (EUMETSAT Advanced Retransmission System). At each station, an EARS node processes the data locally and then relays it on to EUMETSAT for very timely distribution to the user community via EUMETCast and the GTS.

The RDS comprises the following services :

EARS-ASCAT, EARS-ATMS, EARS-ATOVS, EARS-AVHRR, EARS-CrIS, EARS-IASI, EARS-NWC, EARS-VASS and EARS-VIIRS

Service performance is measured in terms of the availability of the data on the EUMETCast user reception stations being within 30 minutes of the instrument's observations, unless specified otherwise in the following slides.

See EUMETSAT's document TD14, available from the 'Regional Data Services' page of EUMETSAT's website (see 'Related Links') for more general information on the various EARS services, including which HRPT stations contribute to each of the services.

ASCAT, ATOVS and AVHRR data from Metop-C were added to EARS as 29 August 2019, IASI L1 as of 25 September, and IASI L2 as of 28 November.

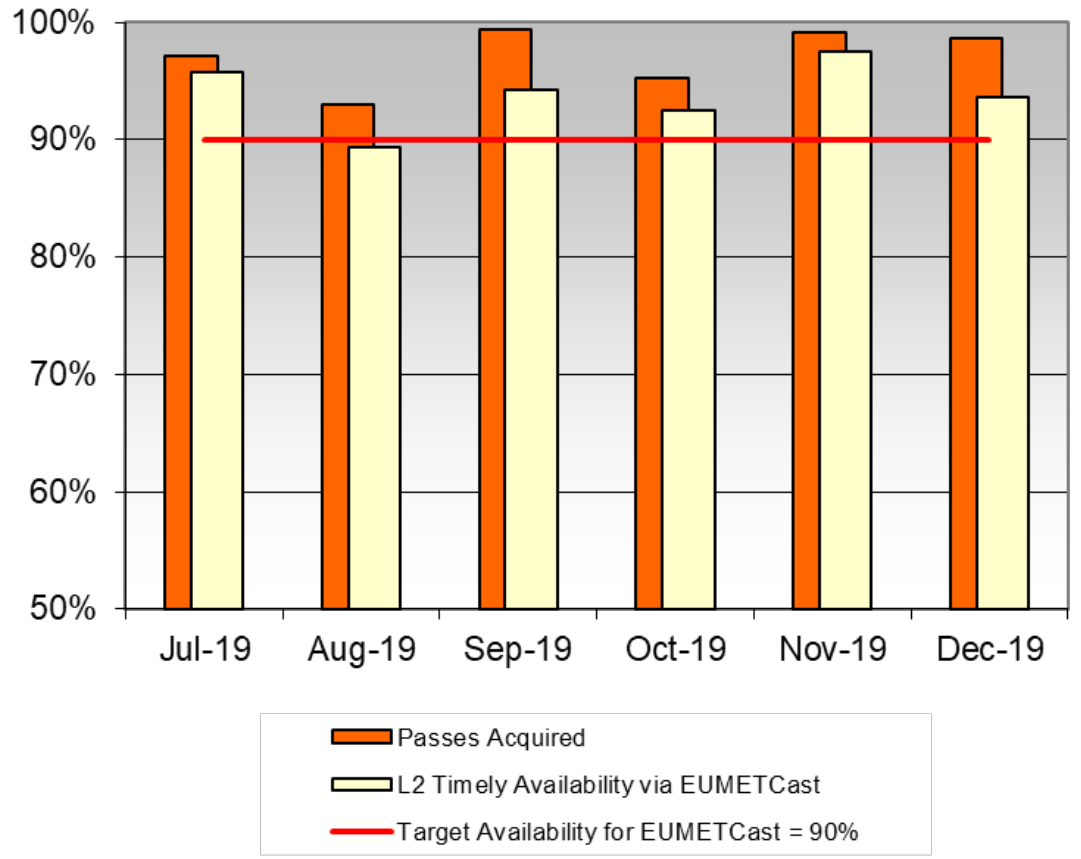
Regional Data Services → EARS-ASCAT

This service provides products derived from the data produced by the ASCAT instruments onboard the Metop satellites.

Level 1 data is produced by the EARS system, and then forwarded to KNMI (Netherlands) for the generation of Level 2 data. Availability shown on the chart is that of the Level 2 data received by users (relative to scheduled passes).

Events which impacted availability:

July/Aug:	Availability impacted by the Metop-A payload switch-off (see slides 8-9) and an outage of several days at the Muscat station.
2-10 Oct:	Intermittent data from St. Denis due to station upgrades.
Nov - Dec:	Moscow reception station hardware problem (faulty L-band downconverter).
17-19 Dec:	No data from Muscat due to a station problem.



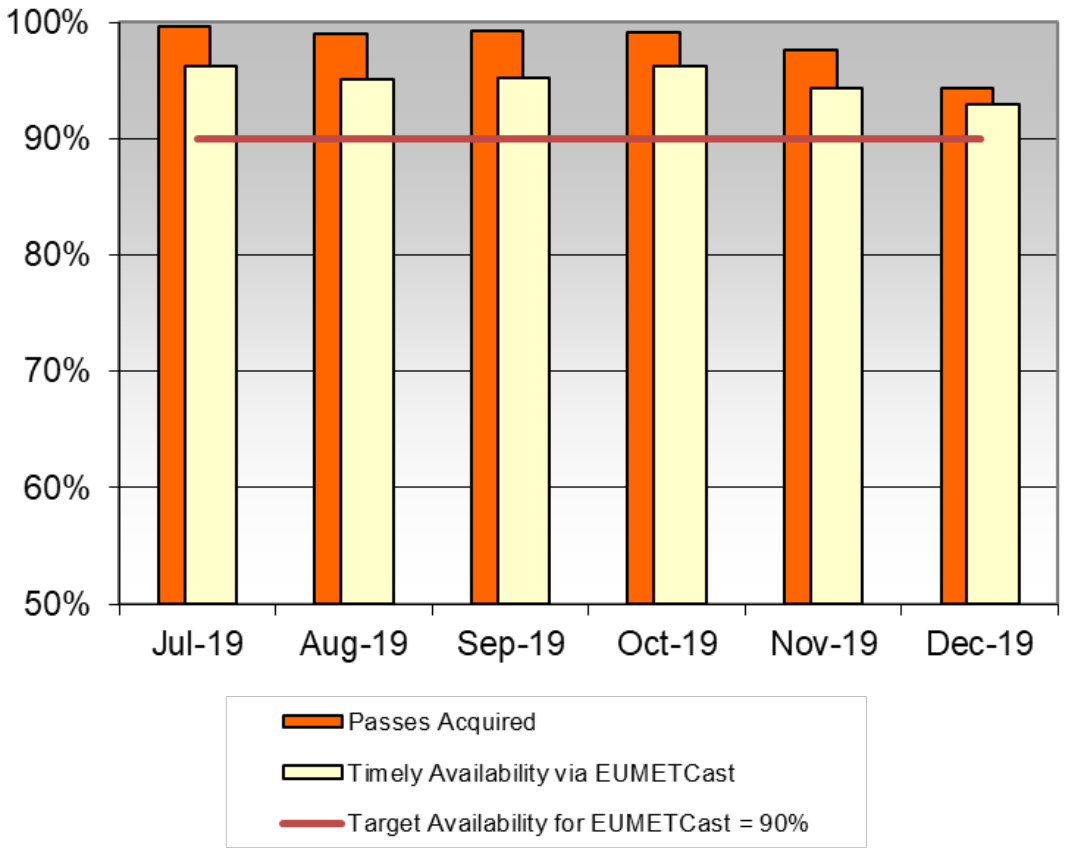
Regional Data Services → EARS-ATMS

This service provides SDRs derived from the data produced by the ATMS (Advanced Technology Microwave Sounder) instrument onboard NASA-NOAA's Suomi-NPP satellite.

Availability shown on the chart is that of the BUFR-formatted SDRs received by users (relative to scheduled passes).

Events which impacted availability:

Nov - Dec: Moscow reception station hardware problem (faulty L-band downconverter).



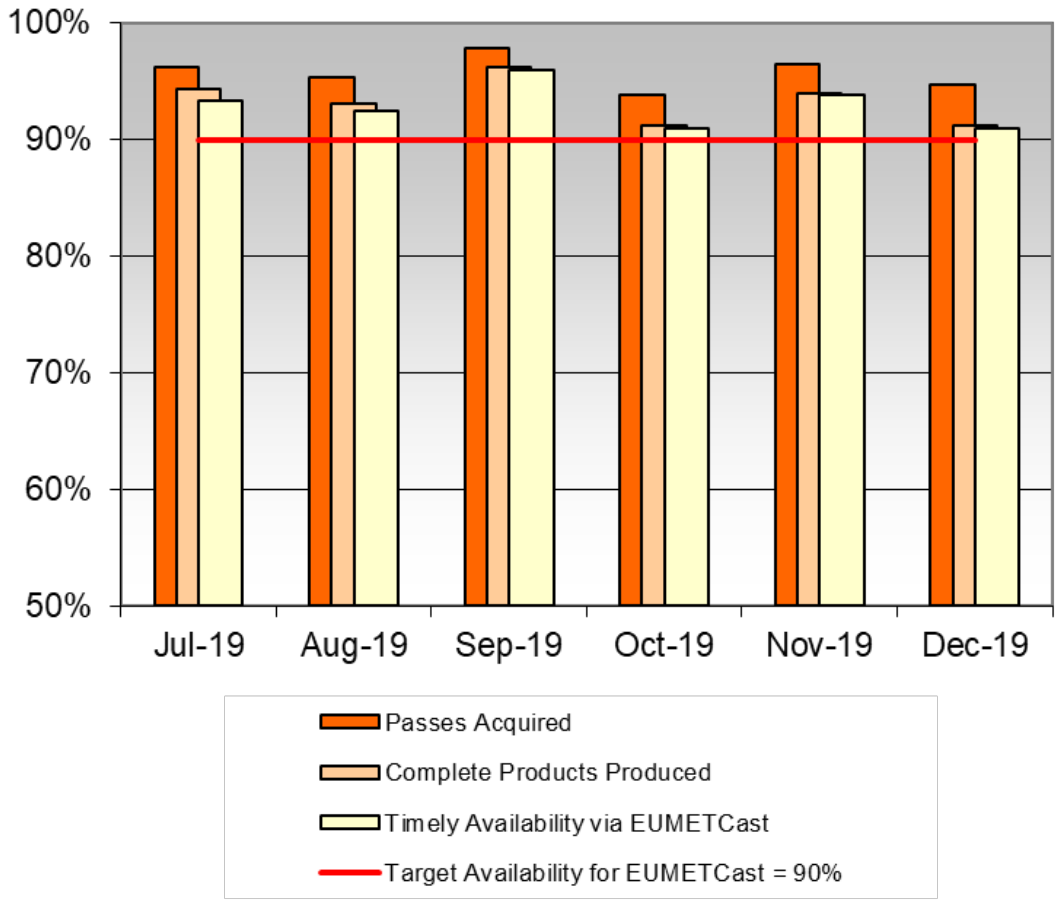
Regional Data Services → EARS-ATOVS

This service provides ATOVS products covering data-sparse areas, derived from AMSU, HIRS and MHS data received by all HRPT stations from the following satellites (listed in order of priority): Metop-B, NOAA-19, Metop-C, NOAA-18, Metop-A. Note that Metop's AHRPT partial coverage data is used.

The availability target shown in red on the chart is that for the products received by users (relative to scheduled ground station passes) and covers Level 1C and 1D products.

Note the less-stringent timeliness target for data from the following HRPT stations:

Edmonton, Gander, Miami & Monterey: 45 mins.



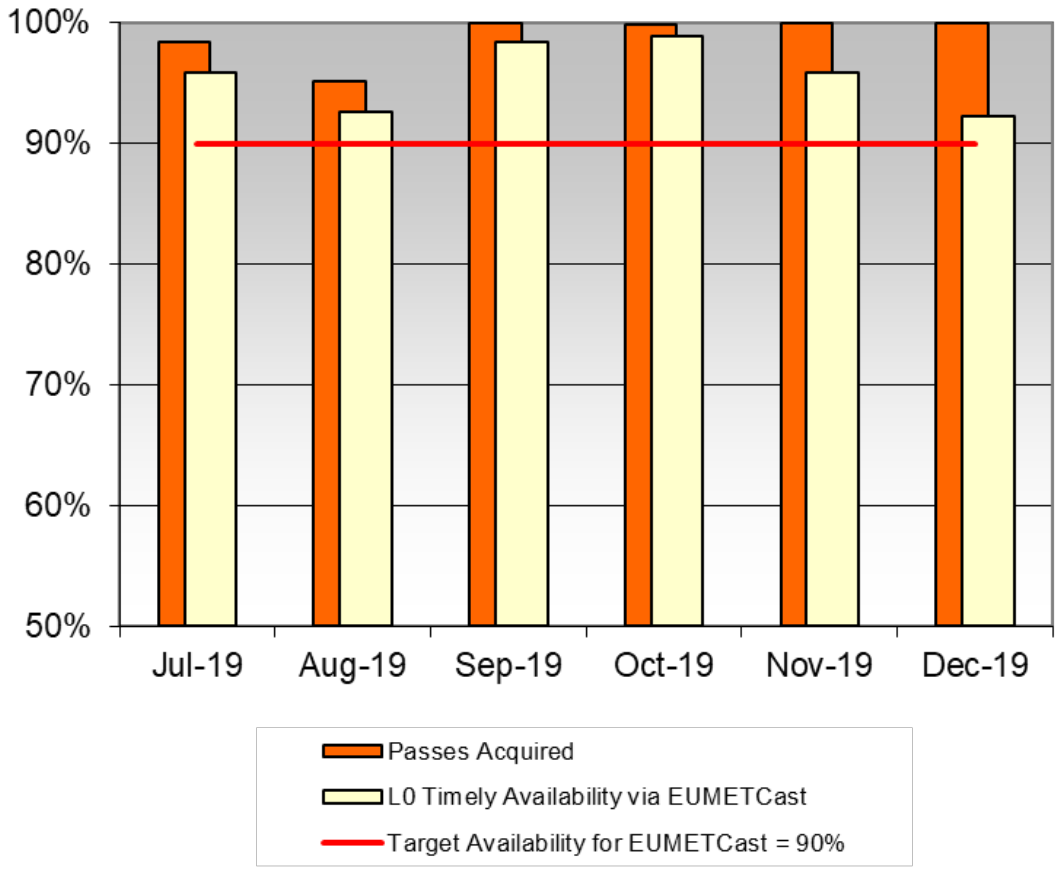
Events which impacted availability:

July/Aug:	Availability impacted by the Metop-A payload switch-off (see slides 8-9).
2-10 Oct:	Intermittent data from St. Denis due to station upgrades.
December:	Processing of ATOVS data for Metop-C failed 4 December onwards, as a result of the satellite drifting to a new orbital position.

Regional Data Services → EARS-AVHRR

This service provides data from the AVHRR instruments onboard NOAA-19 and the Metop satellites. AHRPT partial coverage data and data from the Fast Dump Extract System (FDES) are used from the Metops.

Availability shown on the chart is for Level 0 data received by users (relative to scheduled regional passes). Note that no higher-level products are generated.



Events which impacted availability:

July/Aug: Availability impacted by the Metop-A payload switch-off (see slides 8-9).

December: Processing of AVHRR data for Metop-C failed 4 December onwards, as a result of the satellite drifting to a new orbital position.

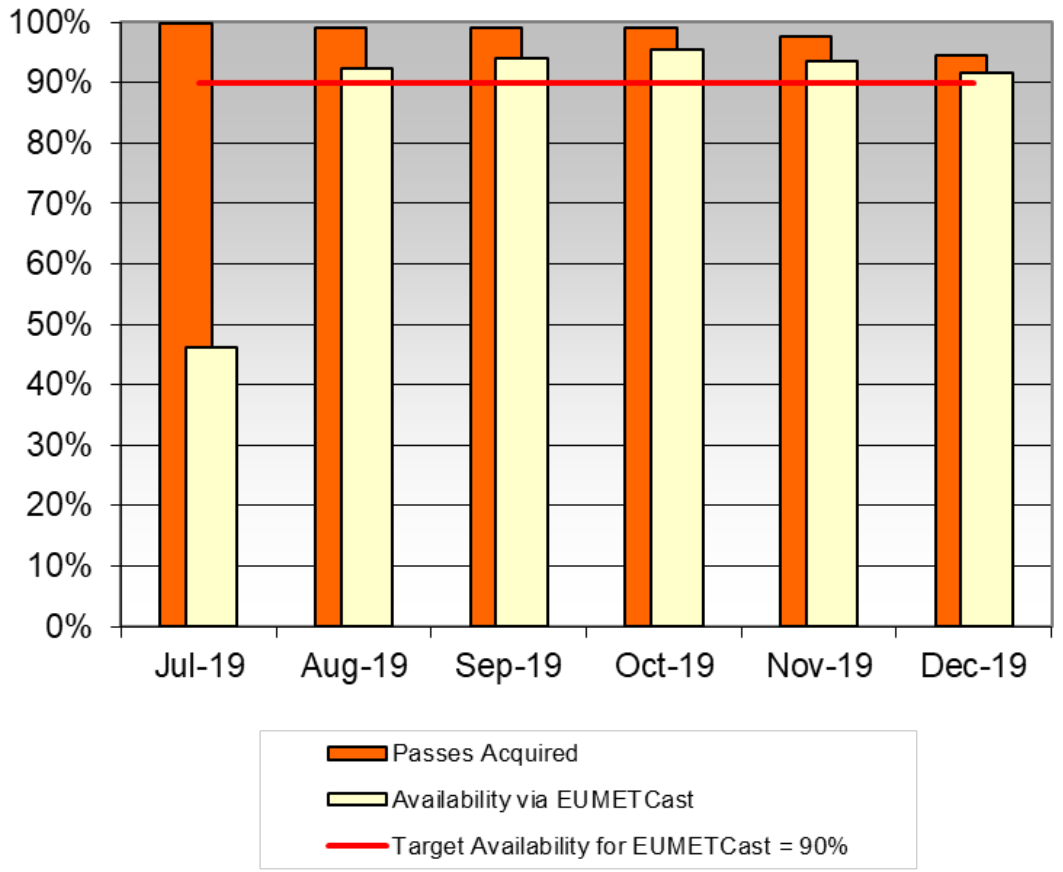
Regional Data Services → EARS-CrIS

This service provides SDRs derived from the data produced by the CrIS (Cross-track Infrared Sounder) instrument onboard NASA-NOAA's Suomi-NPP satellite.

Availability shown on the chart is that of the BUFR-formatted SDRs received by users (relative to scheduled passes).

Events which impacted availability:

3-9 July:	No data from the Moscow station.
1-29 July:	Planned outage for instrument maintenance, needed for recovering from the midwave signal processor failure (activity continued from 26 June)
Nov - Dec:	Moscow reception station hardware problem (faulty L-band downconverter).



Regional Data Services → EARS-IASI

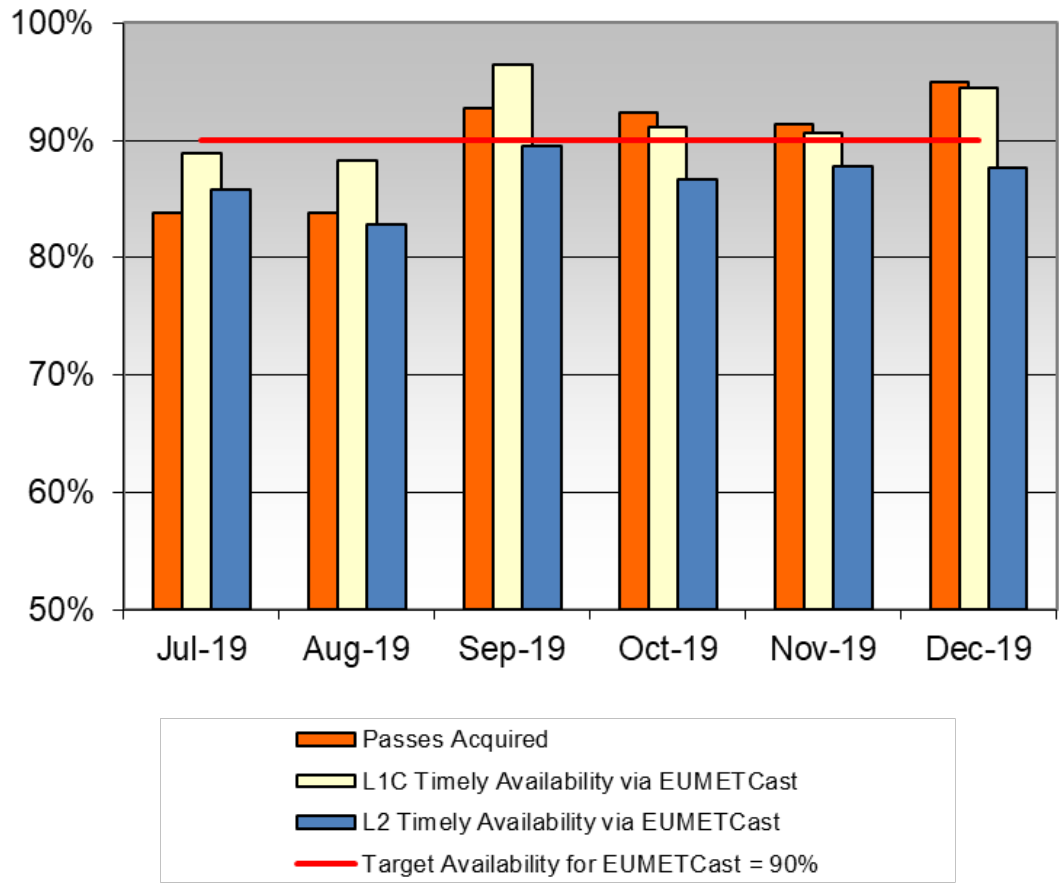
This service provides products derived from the data produced by the IASI instruments onboard the Metop satellites.

Availability shown on the chart is that of the L1C and L2 data received by users (relative to scheduled passes). The products comprise calibrated and geolocated IASI observations containing both 300 Principle Component Scores and 500 original IASI channels, cloud/scene analysis information, BUFR formatted, suitable for nowcasting applications.

Events which impacted availability:

July/Aug:	**Availability impacted by the Metop-A payload switch-off (see slides 8-9).**
Oct - Dec:	**Moscow station problems.**
11-18 Nov:	**No Metop-A data due to onboard software maintenance.**

General Issue: **Incomplete passes in the HRPT zone cannot be processed, hence significantly lower availability of products compared to the passes.**



Regional Data Services → EARS-NWC

This service delivers Level 2 cloud products derived from data produced by the AVHRR instruments onboard Metop-B and NOAA-19.

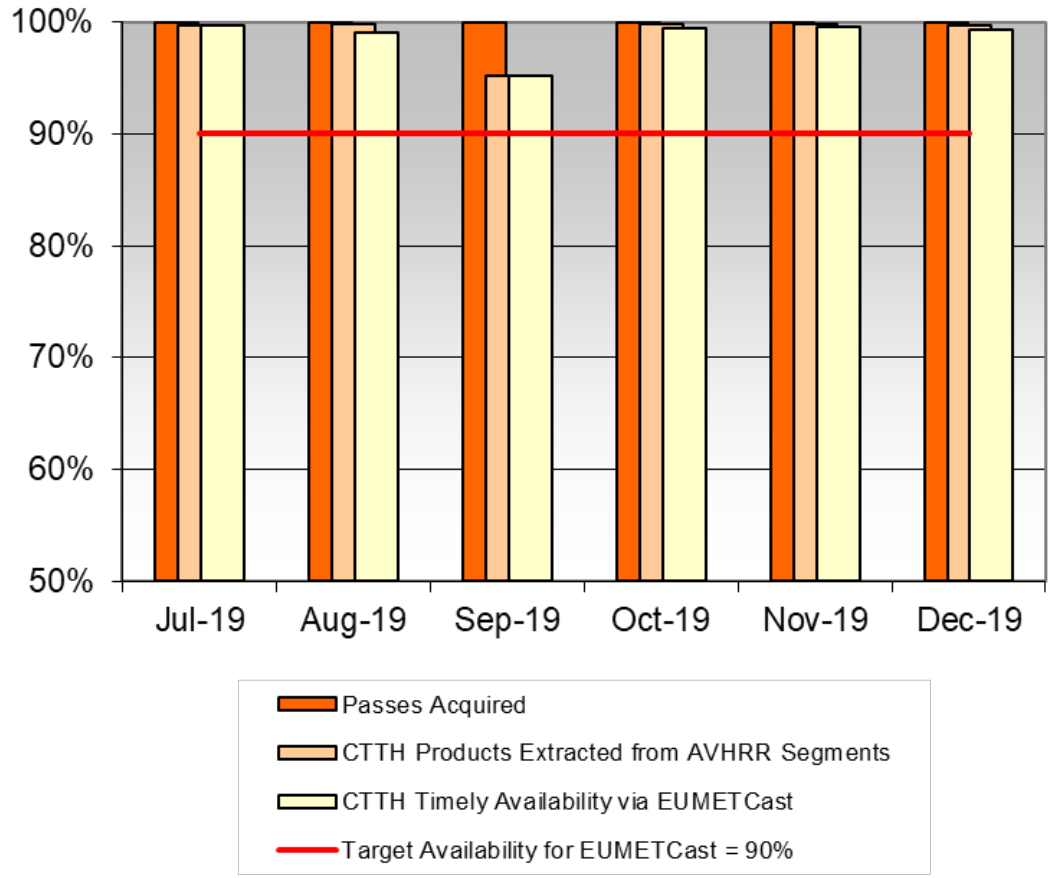
Three types of product are delivered:

- **Cloud-Top Temperature and Height (CTTH)**
- **Cloud Mask (CM)**
- **Cloud Type (CT)**

Availability shown on the chart is currently only that of the CTTH products received by users (relative to scheduled passes).

<u>Events which impacted availability:</u>

31-Aug – 2-Sept: No data due to network switch failure.



Regional Data Services → EARS-VASS

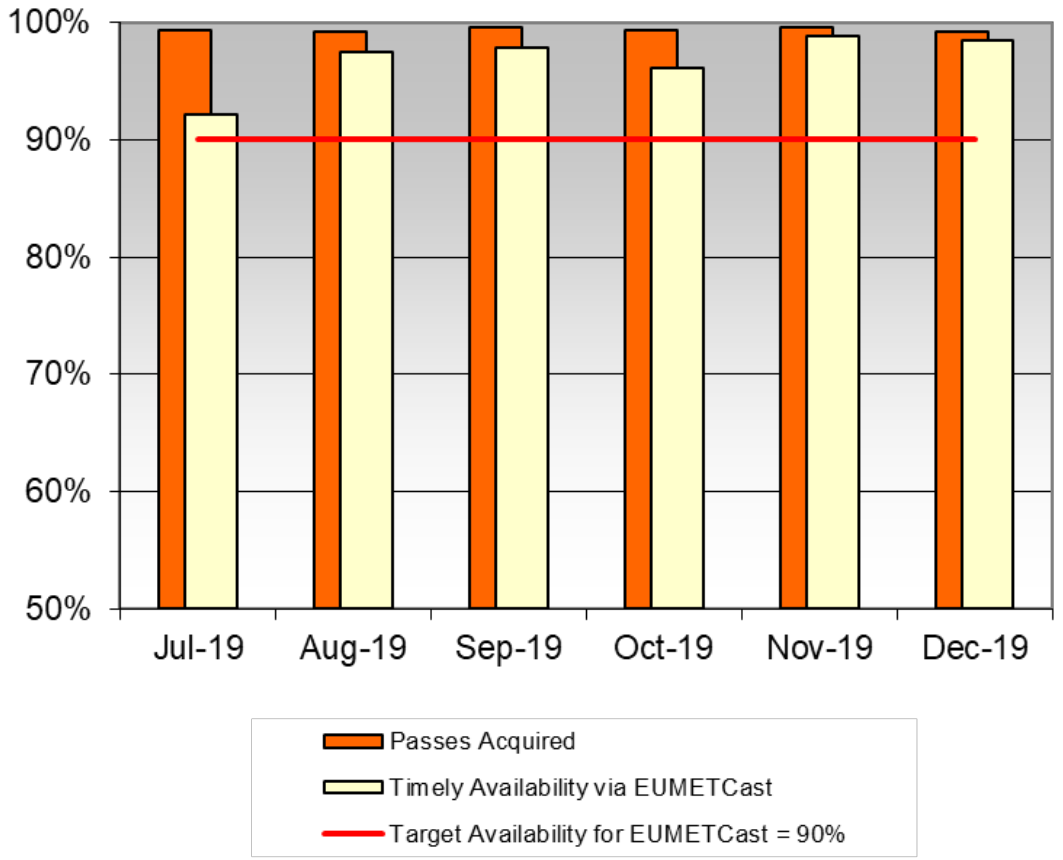
The EARS Vertical Atmospheric Sounding Service (VASS) delivers data processed to L1B from the MWHS-II (Microwave Humidity Sounder II) and IRAS (Infra-Red Atmospheric Sounder) instruments onboard the FY-3C satellite from the China Meteorological Administration (CMA).

Availability shown on the chart is that of the BUFR-formatted L1B data relayed via EUMETCast.

The HRPT stations contributing to the VASS service are Athens, Kangerlussuaq, Lannion, Maspalomas, and Svalbard.

Events which impacted availability:

25-26 July: **Some FY-3C data not processed due to outdated antenna-pointing information.**



Regional Data Services → EARS-VIIRS

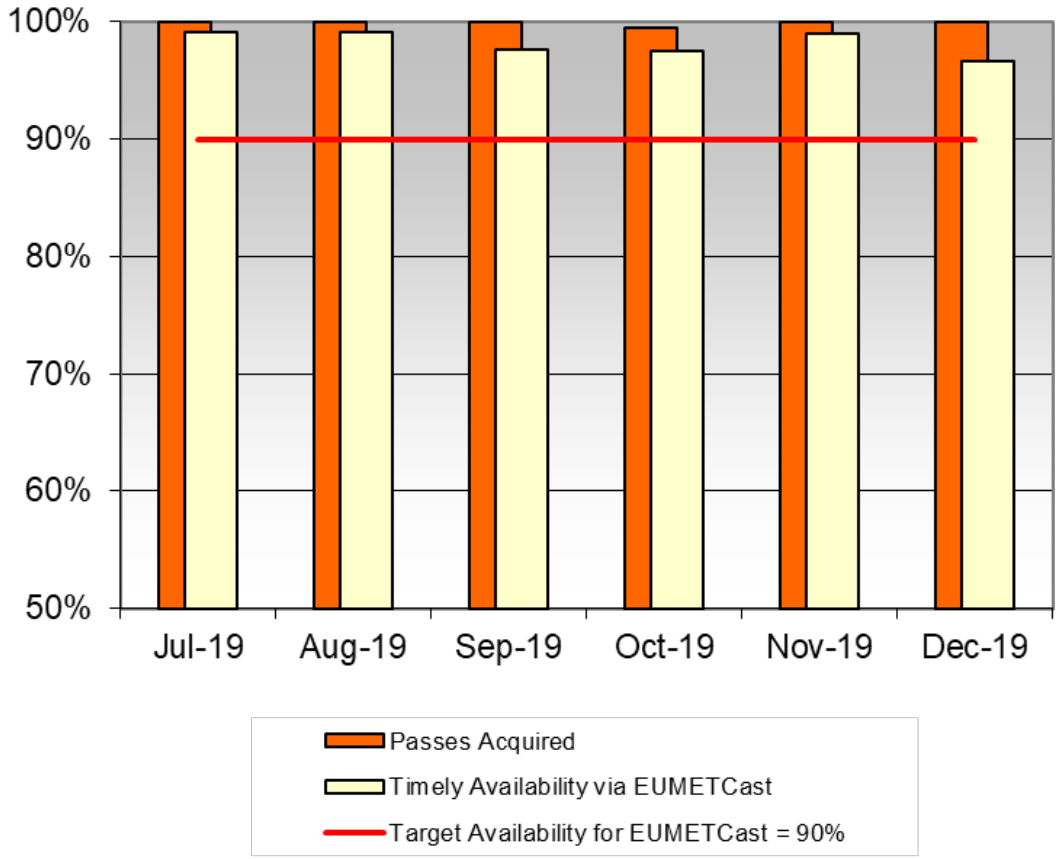
This service delivers products based on M-Band data from the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument onboard NASA-NOAA's Suomi-NPP satellite.

Availability shown on the chart is that of the L1 SDR products received by users (relative to scheduled passes).

The HRPT stations contributing to the VIIRS service are Athens, Kangerlussuaq, Lannion, Maspalomas, and Svalbard.

Events which impacted availability:

None significant.



Search & Rescue Support

EUMETSAT supports the Cospas-Sarsat System for Search and Rescue (SAR) by flying transponders onboard its MSG and Metop satellites (with the exception of Metop-C).

The Cospas-Sarsat System is designed to provide distress alert and location data to assist SAR operations, using a constellation of geostationary and low-altitude Earth-orbiting satellites to relay signals from distress beacons to ground terminals. More information concerning the system can be found on www.cospas-sarsat.org.

MSG: During the reporting period, SAR coverage was provided as follows:

- 0°: Meteosat-11 (continuous coverage)
- 3.5°E: Meteosat-9 (switched off – available as backup)
- 9.5°E: Meteosat-10 (continuous coverage, except for ~5½ hours on 19-Dec, due to a satellite safe-mode)
- 41.5°E: Meteosat-8 (continuous coverage , except for ~16½ hours 24-25 July, due to a satellite payload outage)

Metop: Metop-A and Metop-B have provided full-time SAR support during the reporting period, with only an outage of 5 days, 17 hours form 30-July to 5-August for Metop-A, which resulted from a payload switch-off (see slides 8-9 for more info).

Jason-3 OGDR Service

This service delivers the 'Operation Geophysical Data Record' (OGDR) products, derived from the altimetry data acquired from the Jason-3 satellite.

The Jason-3 mission is a cooperative undertaking between EUMETSAT, NOAA, CNES and NASA, and also involves the European Union, as a Copernicus mission. The European role in Jason-3 operations is funded by Copernicus.

Jason-3 has been supporting the primary service since 1 July 2016. EUMETSAT and NOAA process the data from the satellite in near real-time, and disseminate and archive the products. The chart on the next slide shows the availability of the products over EUMETCast within the timeliness constraint of 3 hours from the time of sensing.

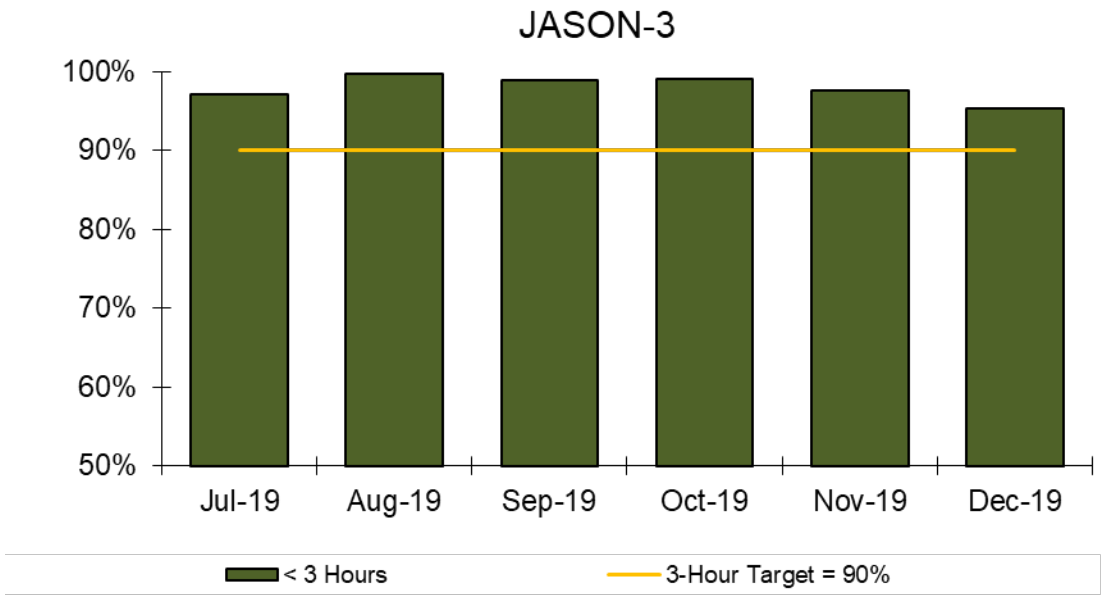
Special note: The Jason-2 mission ended on 1 October 2019, after more than 11 years in orbit and well beyond the foreseen 3-5 year mission baseline, due to ageing-related issues onboard the spacecraft.

Jason-3 OGDR Service

The chart shows the availability of the Jason-3 Operational Geophysical Data Record (OGDR) products disseminated via EUMETCast.

The chart has been simplified to now show only the availability of the data received on EUMETCast reception stations within 3 hours of sensing.

The previous target of 75% has been raised to 90%, to reflect the high availability achieved in general throughout the year. The less-demanding 5-hour timeliness measurement has been removed.



<u>Events which impacted availability:</u>

None significant.

Note: In general, redumps are taken at next visibility (or by other ground station) in cases of problematic passes and connection problems – this minimises data loss, although some impact on timeliness occurs

Third-Party Data Services

In addition to its own satellite data and meteorological products, EUMETSAT also distributes data and products from partner organisations as part of an international cooperation agreement.

Image data from the following geostationary satellites is made available via EUMETCast, Direct Dissemination and the Internet:

- NOAA's GOES-16 ('GOES-East') at 75°W, and as of 14-Feb-2019, GOES-17 ('GOES-West') at 137.2°W
- JMA's Himawari-8 at 140.7°E
- CMA's FY-2G at 105°E (also selected meteorological products).

Meteorological products based on LEO satellite data are also disseminated:

- Microwave Sounder products from CMA's FY-3B and FY-3C (only provided to National Met. Services)
- Level 1, 2 and 3 products derived from data of the MODIS instrument on NASA's Terra & Aqua satellites
- EUMETSAT SSMIS products derived from sounder data of the DoD's DMSP satellites (F16 – F19)
- Operational Geophysical Data Records (OGDRs) from the AltiKa instrument of ISRO/CNES's SARAL mission.

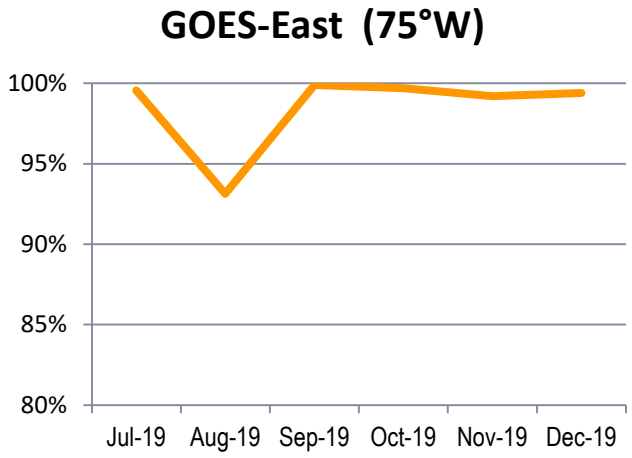
The charts on the following slides show the availability of the data via EUMETCast.

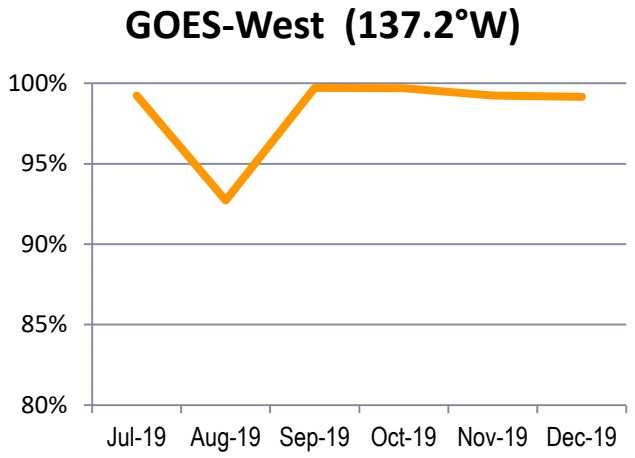
Third-Party Data Services → Geostationary Satellite Data & Products (1 of 2)

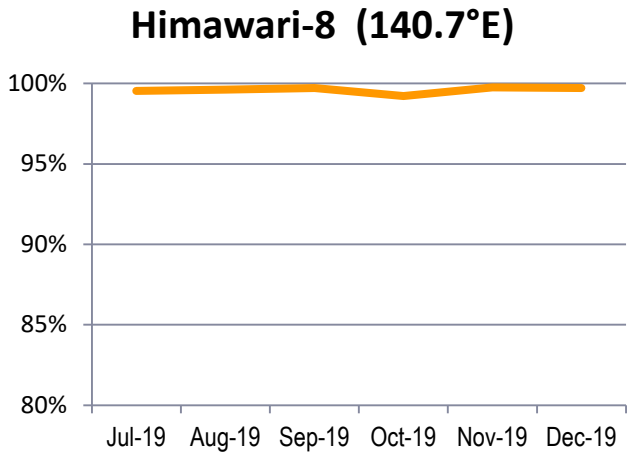
The charts on this slide show the timely availability (as a percentage of expected) of image data originating from the geostationary satellites operated by NOAA and JMA (Japan Meteorological Agency), as disseminated via EUMETCast.

Events which impacted availability:

August: GOES-East and GOES-West: both dataflows disrupted by link problems spanning several days.







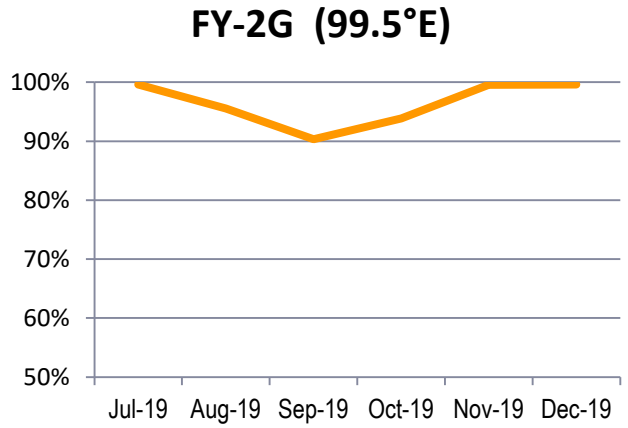
Third-Party Data Services → Geostationary Satellite Data & Products (2 of 2)

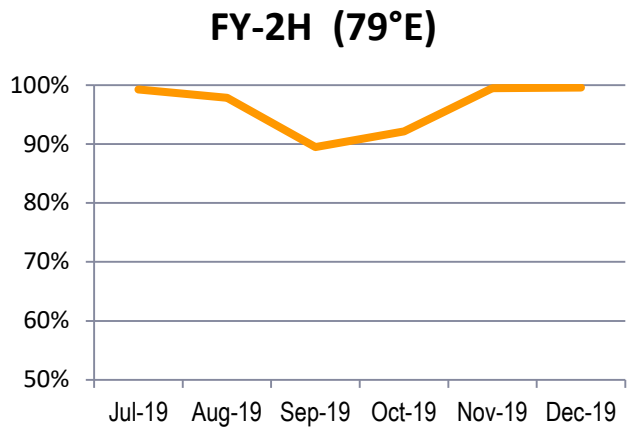
The charts here show the timely availability (as percentage of expected) of selected meteorological products generated from the data acquired by the Fengyun geostationary satellites operated by the China Meteorological Agency (CMA), as disseminated via EUMETCast.

Events which impacted availability:

Aug - Oct: FY-2G and FY-2H: Fewer products due to eclipse-season

The EUMETSAT service for FY-2H started on 13-June.





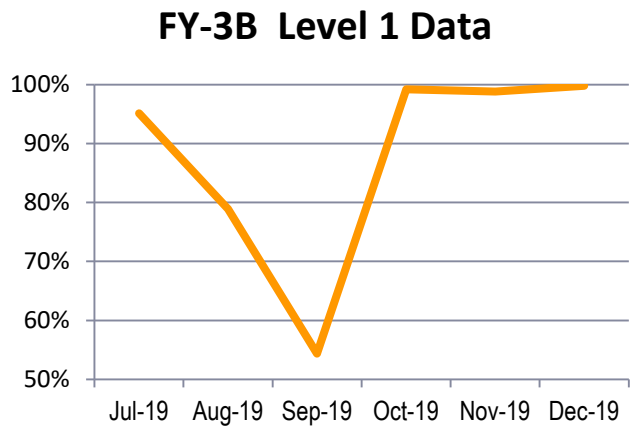
Third-Party Data Services → LEO Satellite Data & Products (1 of 3)

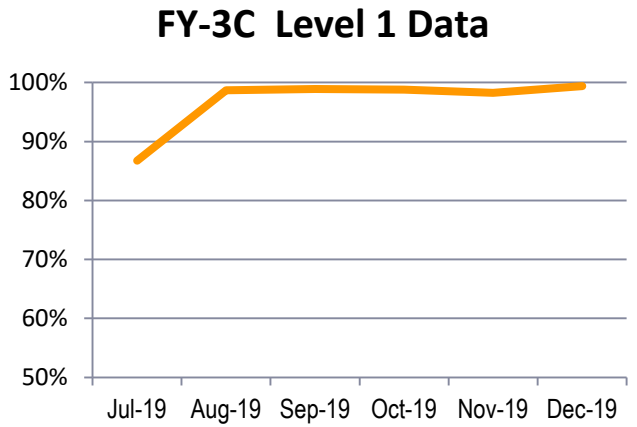
This section presents charts which show the availability of data and products for LEO satellites operated by partner organisations, as disseminated via EUMETCast.

On this slide: Level 1 data from microwave sounder instruments onboard CMA's Fengyun FY-3B and FY-3C satellites (made available only to National Met. Services and ECMWF). Availability shown as percentage of expected.

Events Which Impacted Availability:

15-17 July:	FY-3C: no data received from CMA.
Aug – Sept:	FY-3B: MWRI instrument suspended – no data from 19-August onwards. MWRI excluded from statistics from October onwards.





Third-Party Data Services → LEO Satellite Data & Products (2 of 3)

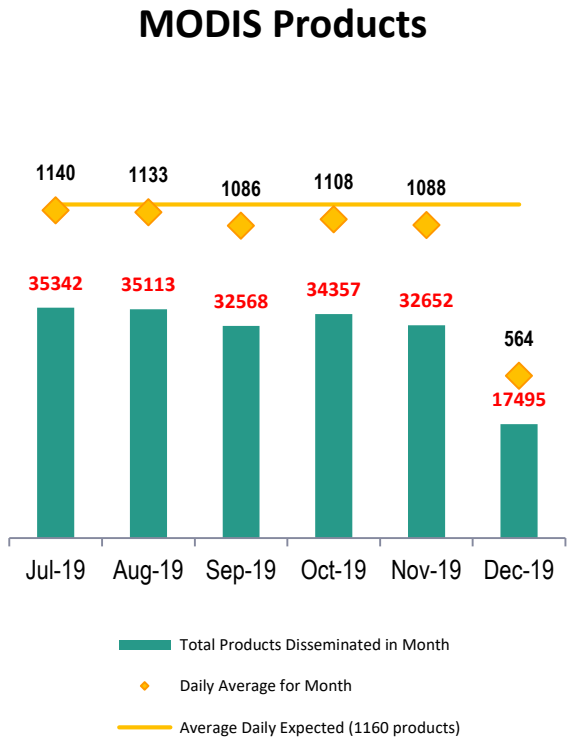
This slide presents further charts showing the availability of certain LEO satellite products from partner organisations, as disseminated via EUMETCast. Availability shown in terms of total products disseminated /month and equivalent daily average/month.

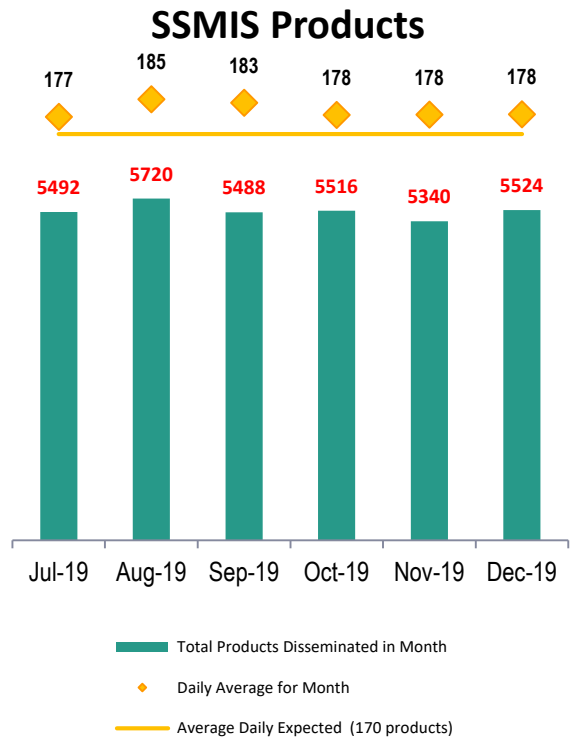
MODIS: Level 1, 2 and 3 regional products derived from the MODIS instruments hosted on NASA's Terra and Aqua LEO satellites.

SSMIS Products: Extracted from SDR data from the 'Special Sensor Microwave Imager Sounder' radiometer onboard the near-polar-orbiting, sun-synchronised DMSP satellites (one of the F16 – F18 series). Each product contains one orbit of data, comprising 4 BUFR component products: IMA, ENV, LAS and UAS.

Events which impacted availability:

Nov - Dec: MODIS: Dissemination of Total Precipitable Water products discontinued as of 28-November.



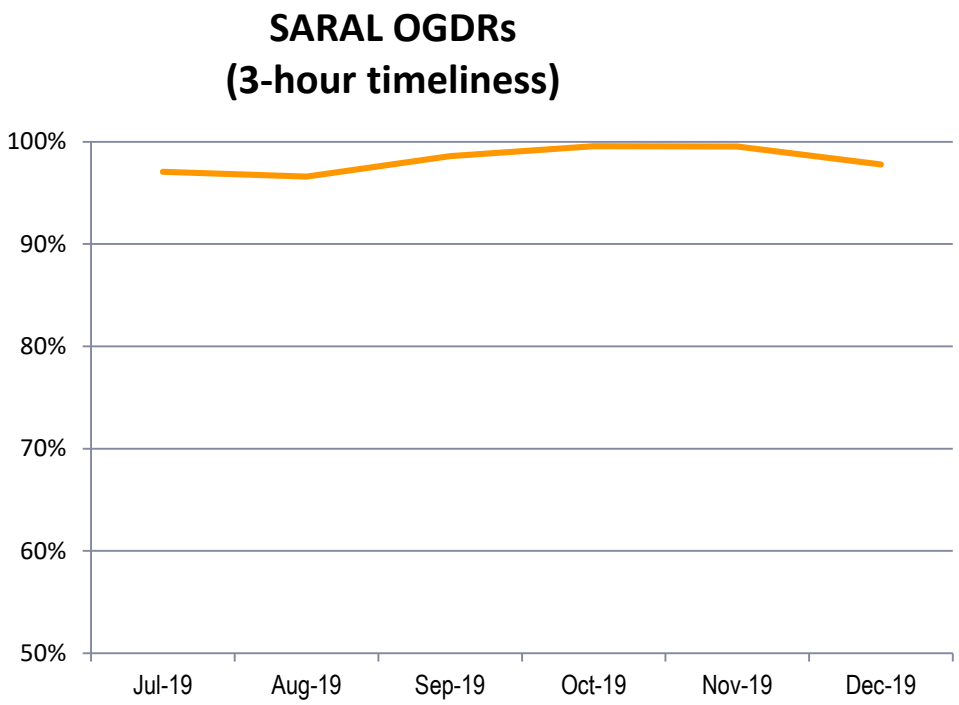


Third-Party Data Services → LEO Satellite Data & Products (3 of 3)

This slide presents a chart showing the availability via EUMETCast of near-real-time Operational Geophysical Data Records (OGDRs), which are produced at EUMETSAT from the data from the 'AltiKa' Ka-band altimeter instrument of ISRO/CNES's SARAL mission.

Each OGDR corresponds to one orbit of data, and their availability is shown as a percentage of the scheduled passes.

75% of the OGDR products shall be made available to the users within 3 hours from data onboard acquisition and 95% of the products within 5 hours.



Events which impacted availability:

None significant.

EUMETCast

EUMETCast is EUMETSAT's primary dissemination mechanism for the near real-time delivery of satellite data and products generated by the EUMETSAT Application Ground Segment. Third-party data and products from partner organisations are also delivered by the system, which is based on Digital Video Broadcast (DVB) technology.

Both EUMETCast Europe and EUMETCast Africa services utilize DVB-S2 technology, the former supported by a Ku-Band transponder on EUTELSAT-10A, and the latter by a C-Band transponder on EUTELSAT-8.

For more information about EUMETCast and the services which it supports, please visit the 'EUMETCast' page on the EUMETSAT website (via 'Data' → 'Data Delivery').

The chart on the following slide shows the availability of the system for the last 12 months, which includes the half-year reporting period.

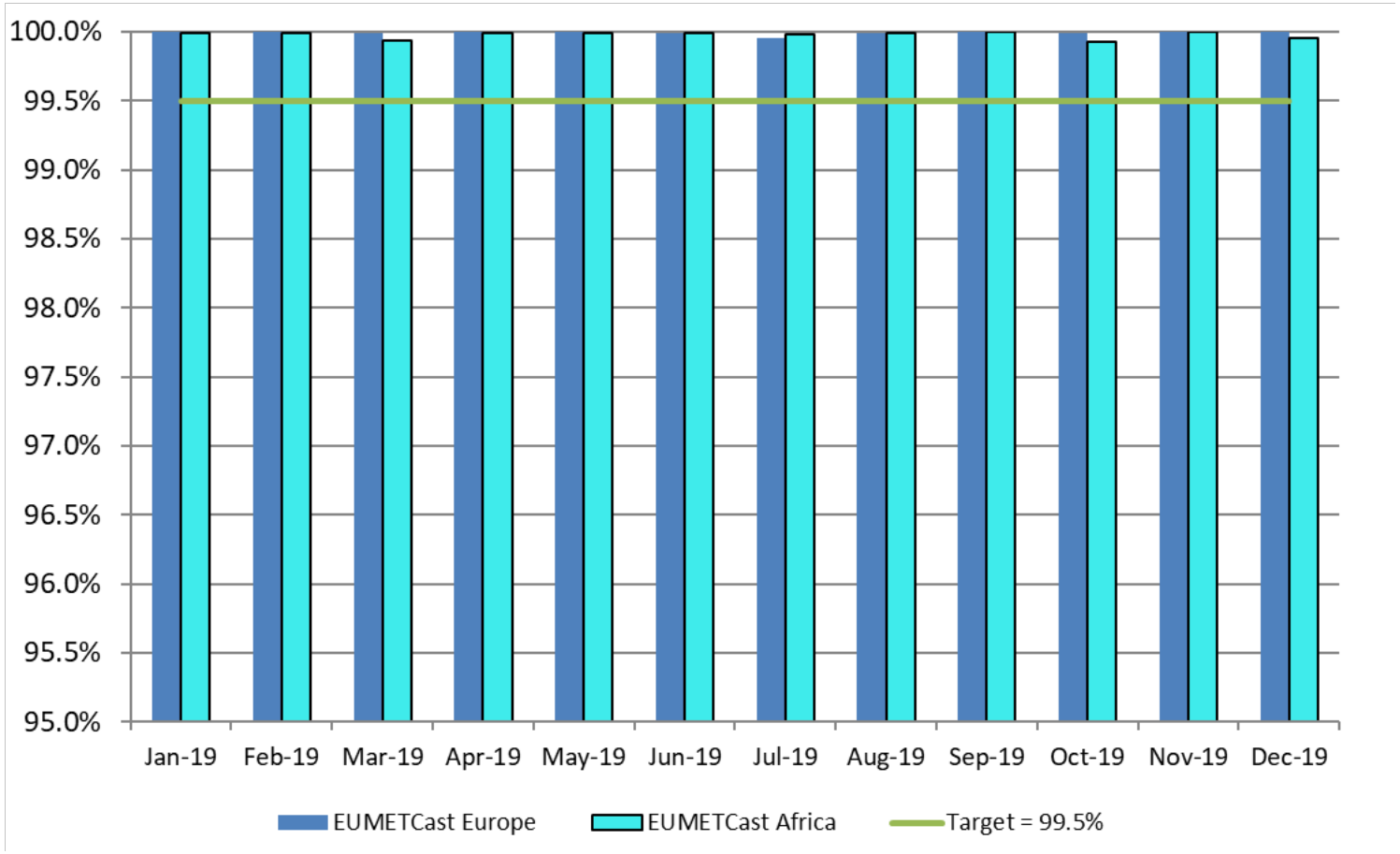
EUMETCast → System Availability for the Year-To-Date

The chart here shows the monthly system availability for the 2 EUMETCast services covering Europe and Africa respectively.

Both services are based on DVB-S2 technology, with EUMETCast Europe being disseminated via Ku-band and EUMETCast Africa via C-band.

Events which impacted availability:

None significant.

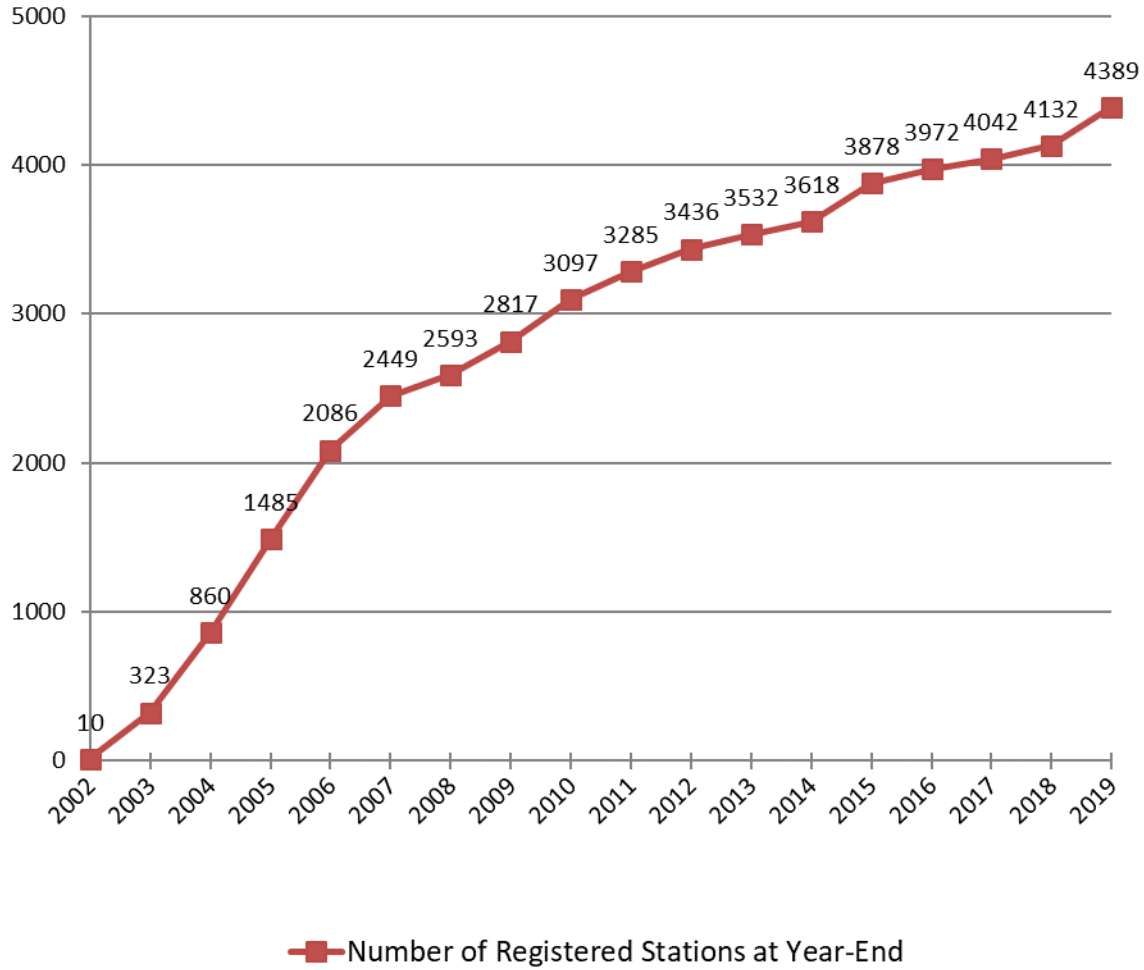


EUMETCast → Registered User Stations

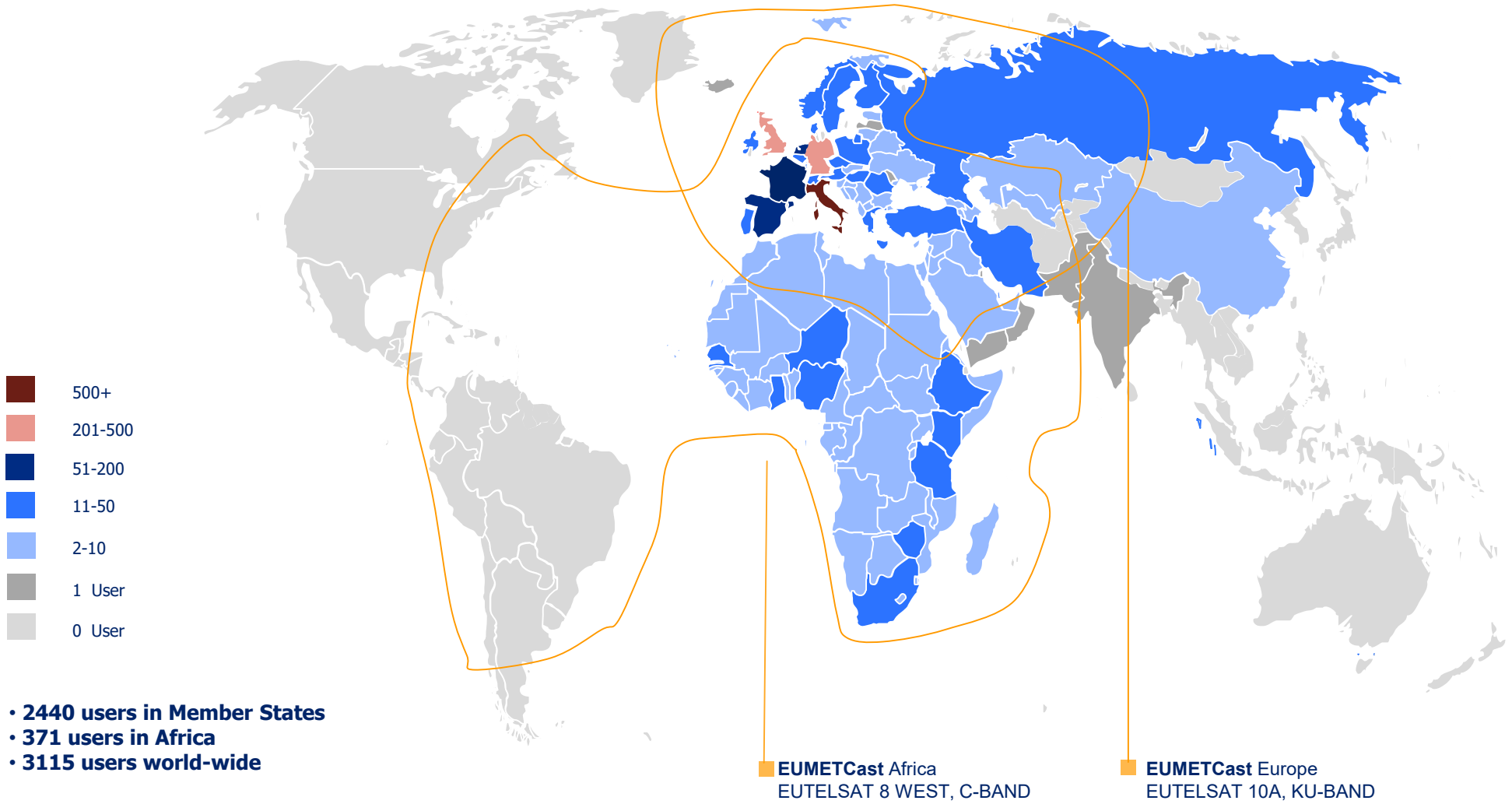
The chart shows the trend of registrations of EUMETCast user stations since the establishment of the system in 2002, up until the end of the reporting period.

Note that the number of registered user stations is larger than the number of users (shown on the next slide) due to some organisations possessing several user stations.

The increase in trend of registrations in 2019 is attributable in part to the change in data policy introduced at the start of the year, which waived the charge for EKUs and reduced licence fees.



EUMETCast → Users Worldwide as of 31 December 2019



The EUMETSAT Data Centre

EUMETSAT's Data Centre archives all payload data acquired from EUMETSAT's operational satellites and most of the products derived from that data.

The Data Centre allows registered users to request data and products from the archive by use of its online 'self-service' ordering mechanism and supplies the requested items via physical media and the Internet. It also allows 'bulk orders' for long time-periods of data and 'standing orders' for repeated delivery of data / products over specified time periods to be requested for special needs.

Charts on the following themes appear on the next 3 slides:

- **Data Delivered: Total Volume versus Items**
- **Archive Orders versus Data To Be Retrieved**
- **Archive Order Delivery-Time Trends**

Note that the charts do not include orders and deliveries of Climate Data Records (CDRs). Although the volumes of CDR deliveries are large (typically many TBs), they are not logged in the automated statistics provided by EUMETSAT's Data Centre.

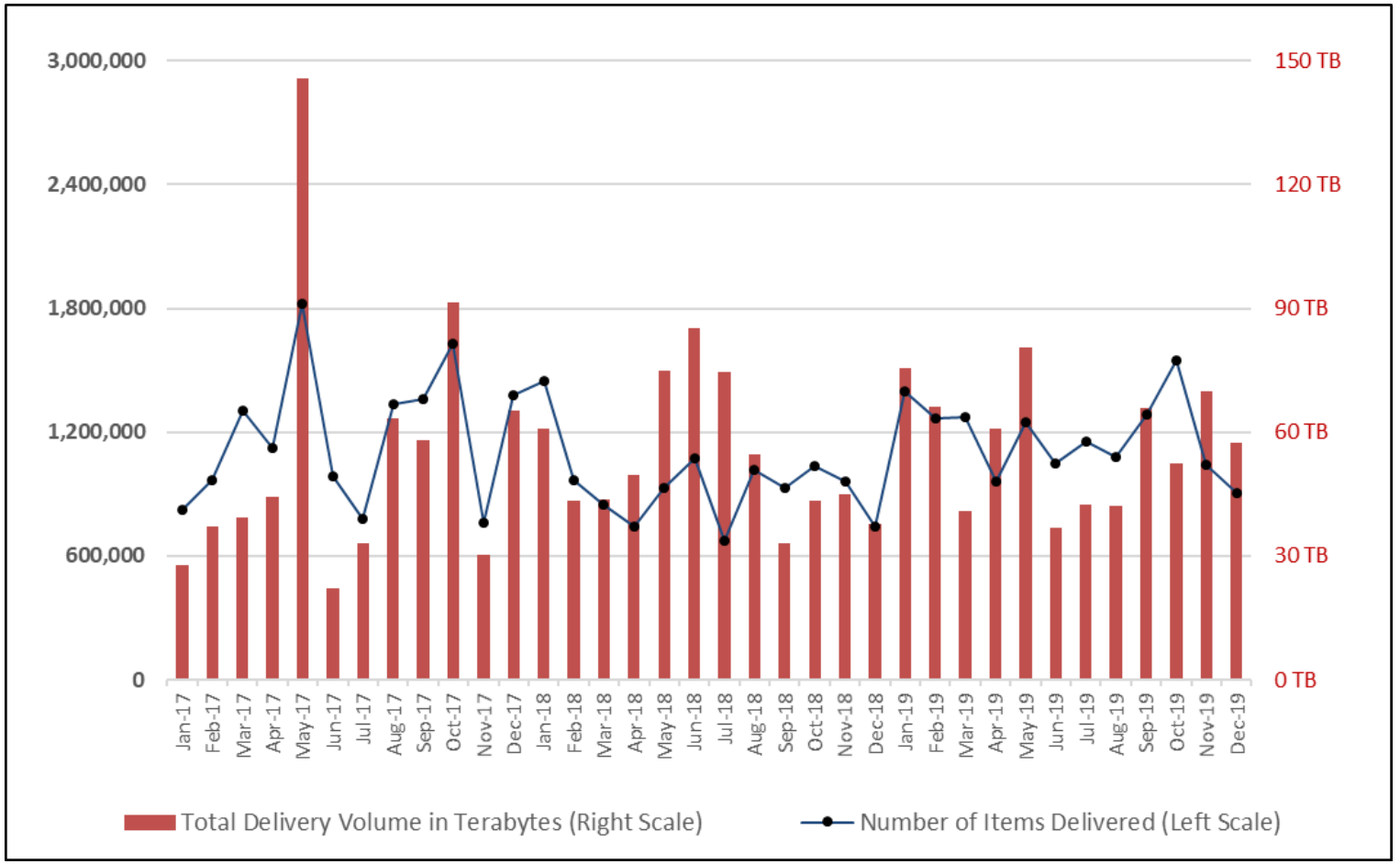
The EUMETSAT Data Centre → Data Delivered: Total Volume versus Items

The chart shows the number of items delivered monthly to the users by the Data Centre, and the corresponding monthly total volumes of data delivered, in the 3 years up to and including the end of the current reporting period.

Items comprise images, products and ancillary files, and the statistics include all items supplied for all types of orders (regular, bulk and standing).

Note for May 2017:

Highest ever delivery volume in a month was achieved (145 TB, ~1.8 million items), since records began.



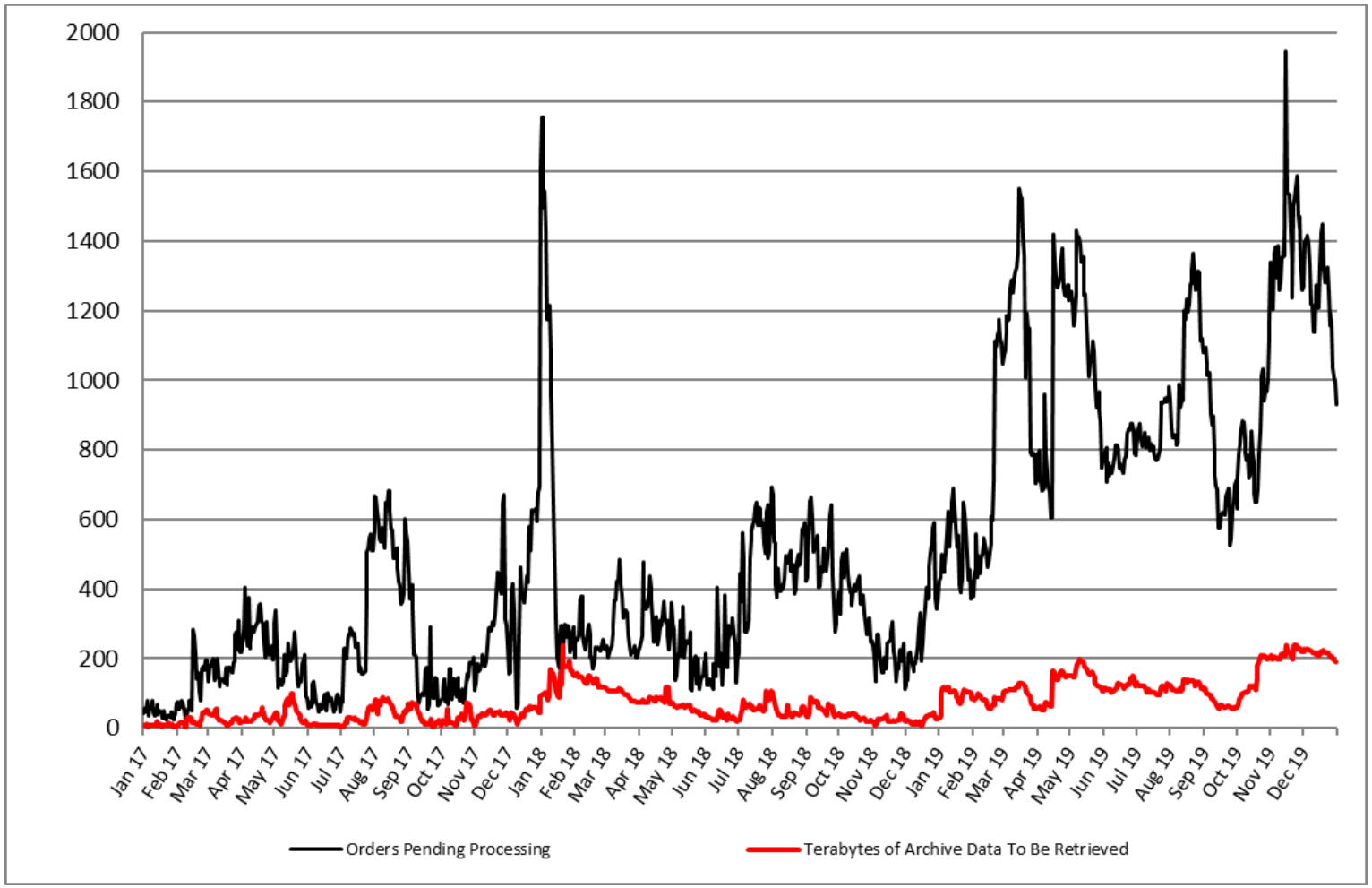
The EUMETSAT Data Centre → Archive Orders versus Data To Be Retrieved

The chart shows the day-by-day profile of archive orders awaiting processing, against the related volume of data needing to be retrieved from the archive and processed to satisfy the queued orders.

The chart is based on observed daily maximum orders and estimated retrieval volumes which are recorded automatically for each day of the year.

A new record peak of Pending Orders was seen in November - this occurred in a reporting period (and indeed the whole of the year 2019) where there has been an increasing trend in orders submitted.

The overall service is running stably and the archive & retrieval system performing within specification, but the situation is being monitored nevertheless.



The EUMETSAT Data Centre → Archive Order Delivery-Time Trends

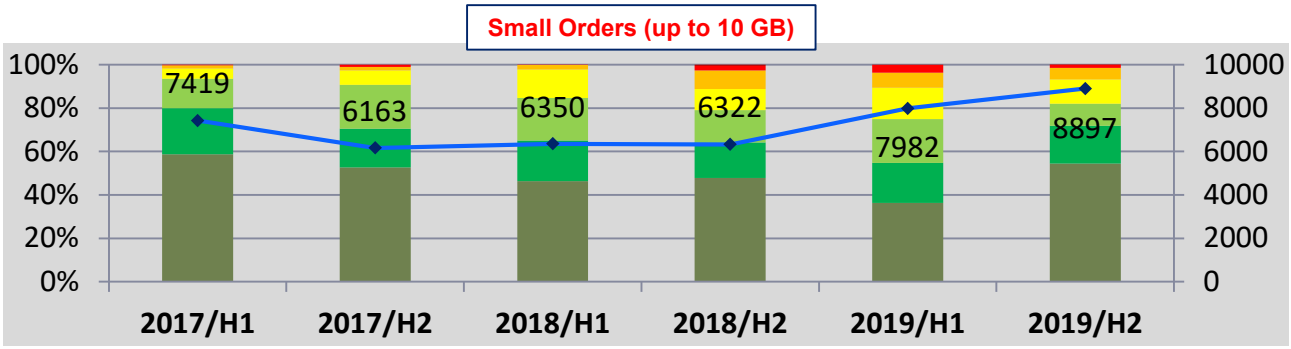
The 3 charts show delivery-time ranges for Data Centre orders according to 3 categories of order size (Small, Medium & Large), for each of the half-year periods shown on the horizontal axis. The left-hand scales help to show the proportions of the total orders delivered in the indicated time ranges (note: standing orders not included).

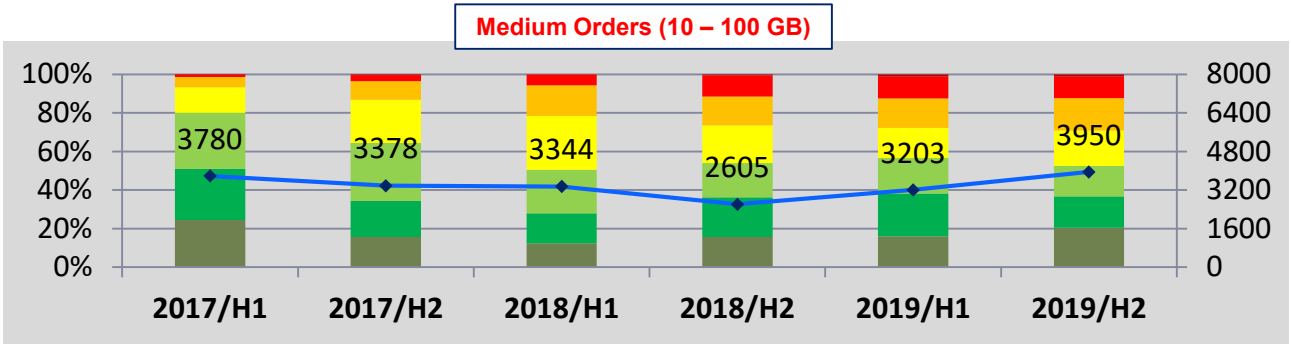
The colour-coding for the delivery-time bands on each of vertical bars on each chart is as follows:

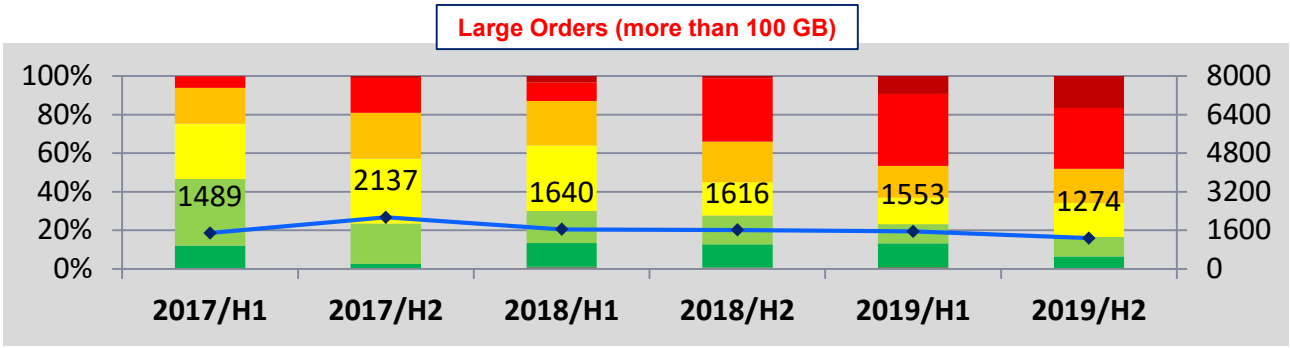
- > 1 month
- < 1 month
- < 1 week
- < 3 days
- < 1 day
- < 6 hours
- < 1 hour

The blue lines indicate the total orders per half year for each category (right-hand scales apply).

An increasing trend in the delivery-times for large orders can be seen in the bottom chart – this is generally a consequence of the overall trend of increasing numbers of orders in 2019. Delivery times for small orders have reduced and those for medium orders has remained stable. The increase in large-order delivery times is not considered a problem, but is nevertheless being monitored.







EUMETSAT's Support to Climate Services

EUMETSAT contributes to climate monitoring and climate change analysis by recalibrating and reprocessing sensor data and products from Meteosat and Metop satellites held in its archive. Improved processing algorithms are applied to the data collected since the 1980's, producing data records with improved overall consistency, with artefacts introduced during past satellite lifetimes corrected.

The following slide gives an overview of the new Climate Data Records made available in EUMETSAT's archive in the reporting period.

For further information on EUMETSAT's role in Climate Monitoring and the European Climate Projects in which it is involved, please see the 'Monitoring Climate' page whose link can be found on the 'What We Do' section under 'About Us' on the EUMETSAT website.

EUMETSAT's Support to Climate Services → Climate Data Record (CDR) Generation

Climate Data Record (CDR) production status at the end of the reporting period:

Produced in 2019/H2:

- Nimbus-6, TIROS-N, NOAA-6, Metop-B HIRS FCDR
- NOAA AVHRR GAC Polar AMV TCDR extension

Previously produced, pending publication:

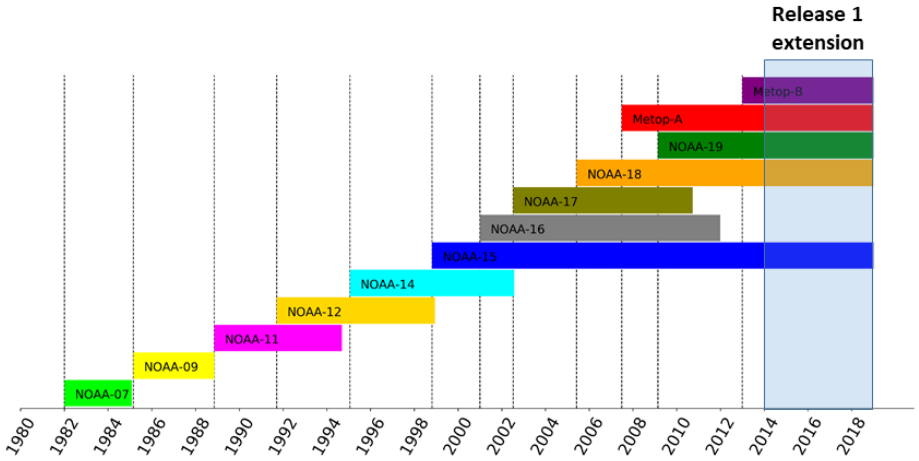
- Metop-A IASI level 1c FCDR – released
- Metop-A/B GRAS bending-angle profiles FCDR (up to 2018) – DRR Oct
- Meteosat FCDR (recalibrated IR M2-9 and VIS M2-7) – DRR Oct
- Metop A/B MHS, S-NPP ATMS, FY-3A/B MWHS-1, FY-3C MWHS-2 Microwave Sounder FCDRs
- Metop A/B AVHRR Global and Polar AMV TCDRs
- Meteosat 8 and 9 surface albedo TCDR
- Meteosat 2-10 ASR, CSR, CLA and AMV TCDR

To be produced in 2020/H1:

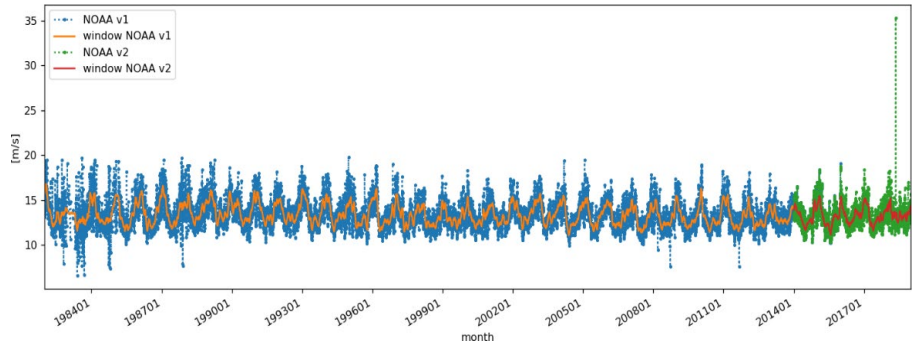
- Metop-A/B GRAS bending-angle profiles FCDR Release 3 (up to 2019)
- Metop A/B IASI L2 TCDR for trace gases

Work-in-progress (ETA) for later release:

- GOME-2 L1B FCDR (2019/20)
- PMAP Aerosol TCDR (2020/21)
- MVIRI full image reprocessing: Release 2 FCDR, 2020 (see note to the right)
- ICDR demonstration for Meteosat AMV and NOAA ATMS



List of satellites carrying an AVHRR instrument used as input for the polar GAC AMVs generation.



Average speed of AMVs retrieved for all satellites per day (Arctic). Release 1 in blue, extension in green

Helpdesk Service

EUMETSAT's User Helpdesk provides support to the users of EUMETSAT's services, handling enquiries, registrations, user feedback comments, problems experienced and enhancement requests.

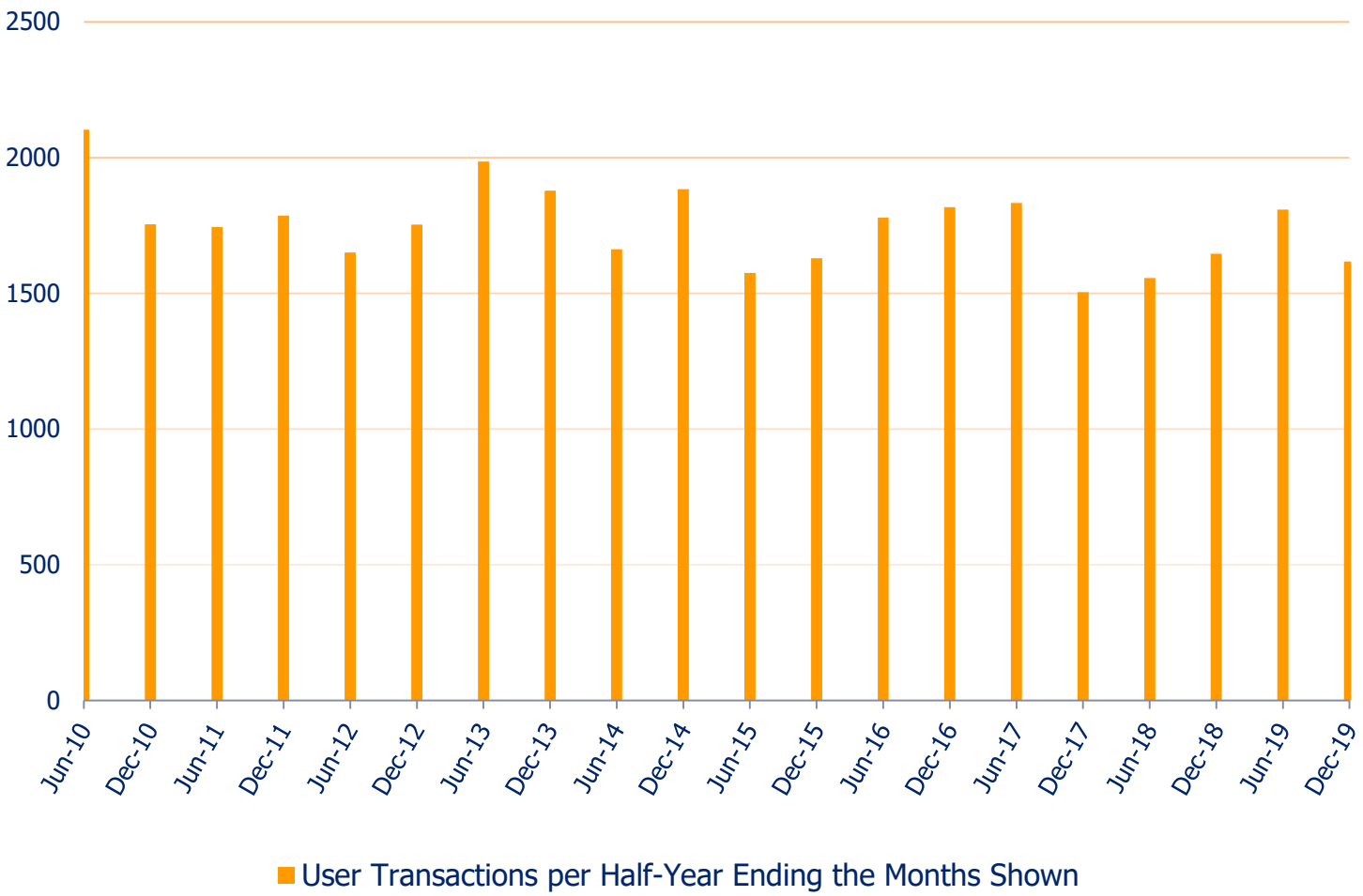
This section includes charts on the following subjects:

- **User interaction history of the last 10 years**
- **The countries and groups that gave rise to the largest numbers of user interactions in the reporting period**
- **Breakdown of those user interactions by category**

Helpdesk Service → User Interaction History

The chart shows the number of user interactions handled by EUMETSAT's User Helpdesk in each half-year of the last 10 years.

The next two slides focus on the user interactions for the current reporting period, in which a total of 1617 interactions were handled.

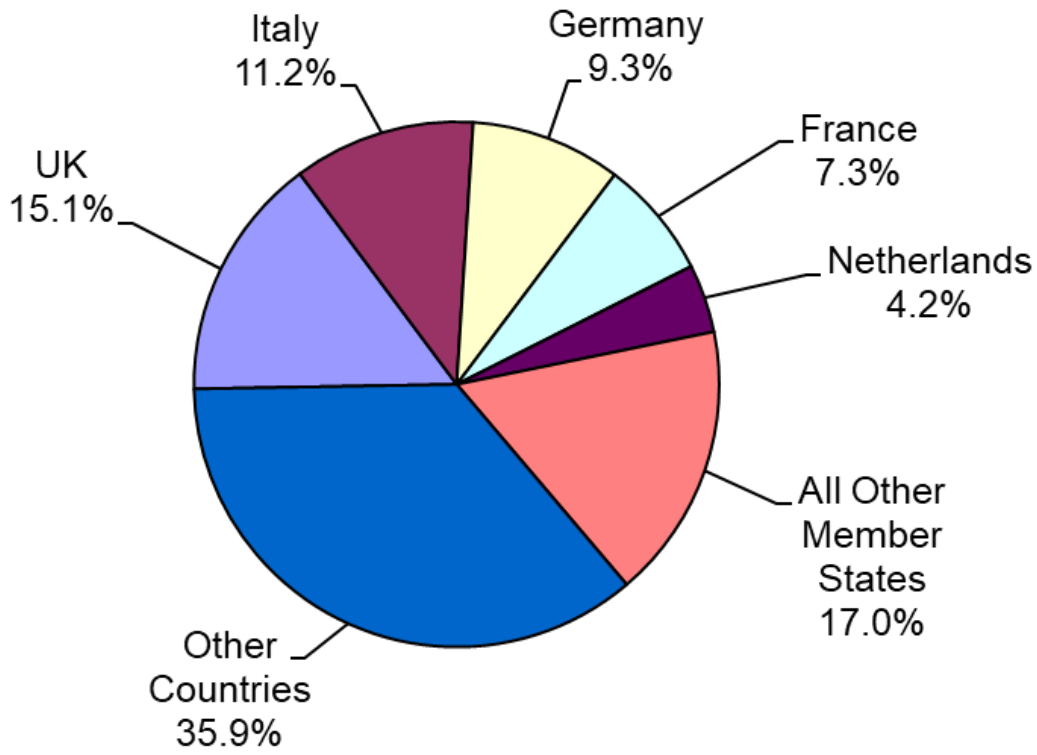


Helpdesk Service → User Interactions 2019/H2 by Country of Origin

The chart shows the interactions in the second half of 2019 from:

(1) the 5 countries that gave rise to the largest numbers of interactions, and

(2) the split of the remainder of the interactions between other Member States and other countries.



Helpdesk Service → User Interactions 2019/H2 by Category

The chart shows the numbers of user interactions in the second half of 2019 for:

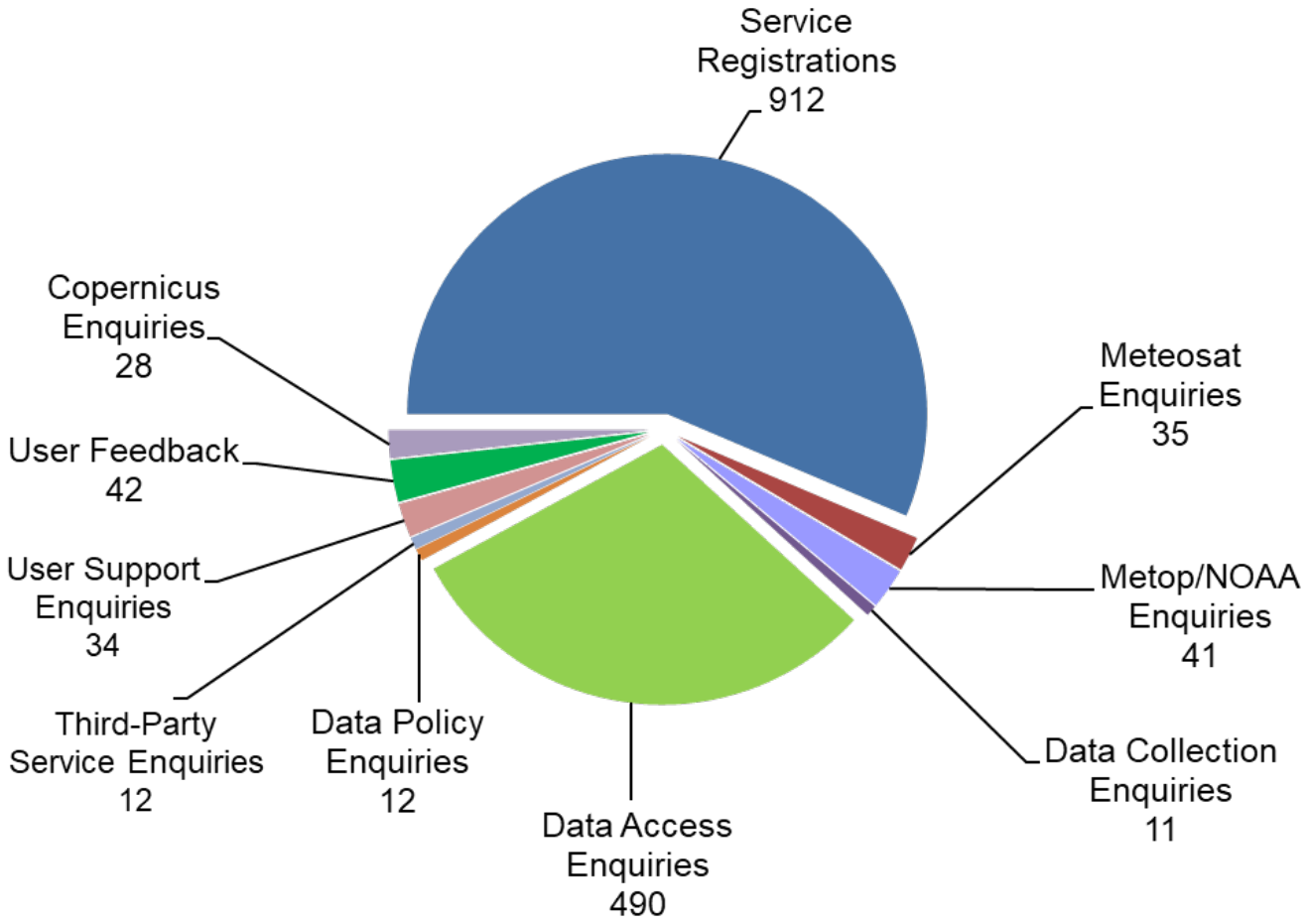
- **Service Enquiries (8 categories)**
- **Service Registrations**
- **User Feedback**

Total interactions for the half-year came to 1617.

Notes:

(1) 'User Support Enquiries' on the chart refer to enquiries related to service messages, web information and training.

(2) 'User Feedback' includes comments on our services and suggestions for improvement



Information on EUMETSAT's Services

The following information is available on the EUMETSAT website, www.eumetsat.int :

Under DATA on the menu-bar, links to sections on the following subjects:

- **Products, services and delivery mechanisms**
- **Training courses and materials**
- **Service Status, including a link to UNS, our User Notification Service**

In addition, details of all products can also be found in EUMETSAT's Product Navigator, accessible under 'Quick Links' from the website's menu-bar.

Glossary (1 of 5)

Special terms used in this report are explained in the table below (continued on several subsequent slides).

Term	Context in which used	Description
A-DCS	Metop-SNPP-NOAA GDS	ADVANCED DATA COLLECTION SYSTEM. Metop instruments contributing to Argos programme. Acquisition and transmission of signals from transmitters on buoys, ships, land sites and mobiles.
AMSU-A	Metop-SNPP-NOAA GDS	ADVANCED MICROWAVE SOUNDING UNIT-A. Multi-channel microwave radiometer used in combination with the HIRS instrument for measuring global atmospheric temperature profiles.
ASCAT	Metop-SNPP-NOAA GDS	ADVANCED SCATTEROMETER. C-band radar which measures near-surface wind speed and direction over the global ocean, and soil moisture.
ATOVS	Metop-SNPP-NOAA GDS	ADVANCED TIROS OPERATIONAL VERTICAL SOUNDERS. Calibrated radiance measurements from the AMSU-A, MHS and HIRS instruments are transformed into various parameters and assembled in the ATOVS L2 product.
AVHRR	Metop-SNPP-NOAA GDS	ADVANCED VERY HIGH RESOLUTION RADIOMETER. Multi-spectral imaging instrument which produces global visible, near-infrared and infrared imagery of clouds, oceans and land surfaces.
CMA	Third-Party Data	China Meteorological Administration (http://2011.cma.gov.cn/en/aboutcma/)
Colinearity	Meteosat	Sun, satellite and ground station come into alignment twice a year, giving rise to disruption of uplink and downlink signals, resulting in partial loss of some images.
DCP	Meteosat	A 'Data Collection Platform' measures and transmits environmental data which is relayed by Meteosat satellite first to EUMETSAT's central operations, and then forwarded on to the DCP operator via direct, EUMETCast or GTS dissemination.
FDES	Regional Data Services	Fast Dump Extract System: This mechanism provides fast access to the most recent part of each X-band dump and transfers the relevant data to the EARS system for Level 1 processing.

Glossary (2 of 5)

Term	Context in which used	Description
FES	Meteosat	Full-Earth Scanning, where the SEVIRI instrument scans the full Earth disc (c.f. RSS).
GDS	Metop-SNPP-NOAA GDS	GLOBAL DATA SERVICE. This is EUMETSAT's service delivering L0, L1 and L2 data and products based on instrument data acquired from the Metop, S-NPP and NOAA Low-Earth-Orbiting satellites.
GOME-2	Metop-SNPP-NOAA GDS	GLOBAL OZONE MONITORING EXPERIMENT-2. Scanning spectrometer instrument used to measure profiles and columnar amounts of ozone and other atmospheric constituents.
GRAS	Metop-SNPP-NOAA GDS	GNSS RECEIVER FOR ATMOSPHERIC SOUNDING. Bending angle / radio occultation instrument for temperature and water-vapour profiling in the troposphere and stratosphere with high vertical resolution.
GTS	General	The 'Global Telecommunications System', established by the WMO, is used by national meteorological services to exchange meteorological data and products. See also 'RMDCN'.
HIRS	Metop-SNPP-NOAA GDS	HIGH-RESOLUTION INFRARED RADIATION SOUNDER. Heritage atmospheric soundings of temperature and humidity in cloud-free conditions.
IASI	Metop-SNPP-NOAA GDS	INFRARED ATMOSPHERIC SOUNDING INTERFEROMETER. A multi-purpose sounding instrument used for enhanced atmospheric soundings of temperature, humidity and trace gases in cloud-free and partly-cloudy conditions, as well as surface temperature, cloud characteristics and surface emissivity.
IODC	Meteosat	Indian Ocean Data Coverage: FES L1.5 image data, met products and DCPs, from Met-8 at 41.5°E.
JMA	Third-Party Data	Japan Meteorological Agency (http://www.jma.go.jp/jma/indexe.html)

Glossary (3 of 5)

Term	Context in which used	Description
Level 0	Metop-SNPP-NOAA GDS	An instrument's raw data which has been demultiplexed from the total set of data dumped from one orbit of the Metop satellite.
Level 1.0	Meteosat	The raw image data acquired from a Meteosat satellite and preprocessed at the ground station, which is then received by a EUMETSAT image-processing facility, to be geometrically rectified and radiometrically corrected.
Level 1.5	Meteosat	Level 1.0 image data that has been corrected for radiometric and geometric non-linearity and is accompanied by the appropriate ancillary information that allows the user to calculate the geographical position and radiance of any pixel.
Level 1A	Metop-SNPP-NOAA GDS	Instrument data in full resolution with radiometric and geometric (i.e. Earth location) calibration computed and appended but not applied.
Level 1B	Metop-SNPP-NOAA GDS	Calibrated, earth-located and quality-controlled product, in the original pixel location, packaged with ancillary, engineering and auxiliary data.
Level 1C	Metop-SNPP-NOAA GDS	In the case of the IASI spectra, Level 1B data after the application of the apodization function.
Level 1D	Metop-SNPP-NOAA Regional Data	For EARS-ATOVS, AVHRR derived cloud information on HIRS grid.
Level 2	Metop-SNPP-NOAA GDS	Earth-located values converted to geophysical parameters at the same spatial and temporal sampling as the Level 1B and 1C data.

Glossary (4 of 5)

Term	Context in which used	Description
MHS	Metop-SNPP-NOAA GDS	MICROWAVE HUMIDITY SOUNDER. 5-channel microwave instrument for atmospheric humidity sounding in all weather conditions.
NOAA	Metop-SNPP-NOAA GDS and Third-Party	National Oceanic and Atmospheric Administration (http://www.noaa.gov/)
Nominal RCs	Meteosat (0° SEVIRI)	SEVIRI repeat cycles consisting of geometrically and radiometrically-corrected data in all 12 channels, with less than 18 missing detector lines in the scanned Earth area for any given spectral channel (54 for HRV), where less than 12 of those lines (36 for HRV) are adjacent to each other.
'On-Time'	All	The data or product has been generated or received 'on-time' at a specified location (e.g. at generation facility or EUMETCast user station respectively) within the relevant timeliness constraint.
OOP	Metop	'Out-Of-Plane' manoeuvre, i.e. one conducted with a Metop satellite in order to adjust the inclination of its orbit.
PGF	Metop performance charts	The Metop 'Product Generation Facility' is the part of the EPS CGS (Core Ground System) which generates Level 0 data and controls the generation of Level 1 and 2 products by the relevant PPFs (Product Processing Facilities).
Repeat Cycles (or RCs)	Meteosat (0° SEVIRI)	The period in which the MSG SEVIRI instrument performs one scan and then is repositioned ready for the next repeat cycle. A nominal repeat cycle (a scan of the entire Earth disc) has a duration of 15 minutes.

Glossary (5 of 5) (end of report)

Term	Context in which used	Description
RMDCN	General	The 'Regional Meteorological Data Communication Network' is used by WMO Region VI to carry GTS traffic within Europe. See also 'GTS'.
RSS	Meteosat (9.5° SEVIRI)	Rapid-Scan Service (for MSG), where the repeat cycle has a duration of only 5 minutes, covering the latitude range of 15 to 70°N.
SEM	Metop-SNPP-NOAA GDS	The 'Space Environment Monitor' consists of a pair of instruments which provide data to determine the intensity of the Earth's radiation belts and the flux of charged particles at the satellite's orbiting altitude.
SEU	Satellite or instrument outages	'Single Event Upset', the term used to refer to an effect on onboard electronics caused by charged particles (e.g. solar), possibly resulting in a switch-off of an electronic system.
SEVIRI	Meteosat Second Generation (MSG)	Spinning Enhanced Visible and Infra-Red Imager

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