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STATUS OF EUMETSAT POLAR SYSTEM (EPS)

This document presents the status of the EPS programme as of August 2010.

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1 OVERVIEW

The operational status of the EPS low earth orbit polar system is stable and the Metop-A satellite continues to perform well over the reporting period, with only limited unplanned outages occurring on IASI, GRAS, ASCAT and A-DCS.

In-Plane Manoeuvres, GOME instrument throughput performance testing, IASI instrument software upload and other routine instrument maintenance led to some further, planned minor losses of operational data.

In particular, it can be noted that the Metop-A platform has continued to behave nominally without any major anomaly (e.g. Payload switch off).

The redundant A-HRPT has continued to be operated according to switching zones defined according to the trade-off between user needs and radiation risk. Due the situation of NOAA17 a new extension of new switching zones is being analysed and is given section 2.2

Dissemination of Metop-A products has continued nominally during the reporting period (except for the above mentioned outages). The operational level 1 product services: ATOVS, AVHRR, IASI, GOME, GRAS, ASCAT, and level 2 product services: ASCAT soil moisture, ATOVS and IASI retrievals, have continued nominally.

2 SPACE SEGMENT

2.1 Satellite Status and Configuration

The Metop-A Platform Service Module (SVM) has been performing well during the reporting period, with an Out-of-Plane (OOP) manoeuvre executed successfully on 17th Sept 2009 It shall be noted that due to the good behaviour of the platform regarding the prediction, the touch-up one-burn In-Plane (IP) manoeuvre which had been foreseen for 2009/09/24 to correct for residual drift was not necessary. The orbit eccentricity reached was also satisfactory for ASCAT calibration campaign operations. Routine single burn IP manoeuvres have been then executed the 10th Dec 2009 and 19th of June 2010 leading to planned outages on SEM and GOME data.

It shall be noted that ASCAT calibration campaigns led to some further planned losses of operational data. Please refer to Section 2.6 concerning this campaign.

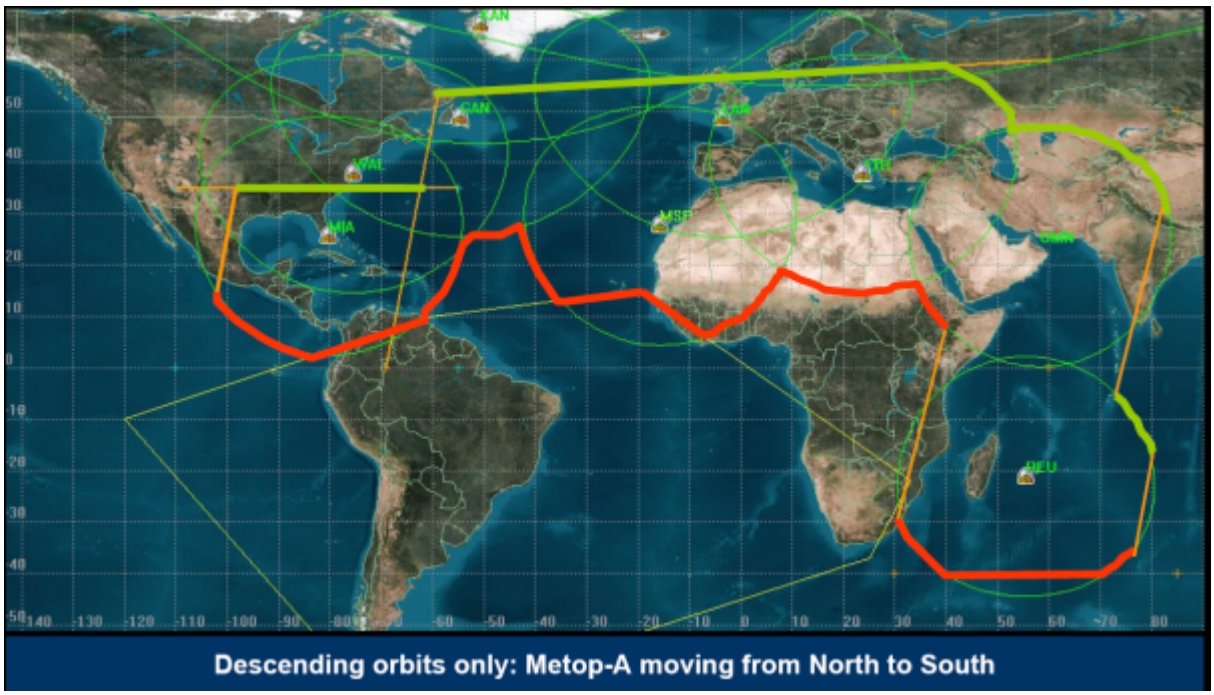
The SVM CCU is currently using the redundant I/O board following the incident (number 31) from January 2008 as reported previously.

The nominal HRPT suffered a permanent failure on 4 July 2007 and the redundant HRPT entered in operation the 29 September 2008 following a specific scenario minimising the risk of failure by switching on the demodulator only for restricted geographic areas.

The A-DCS instrument is configured on the redundant, B-side since 22 March 2007 and is performing nominally in this configuration.

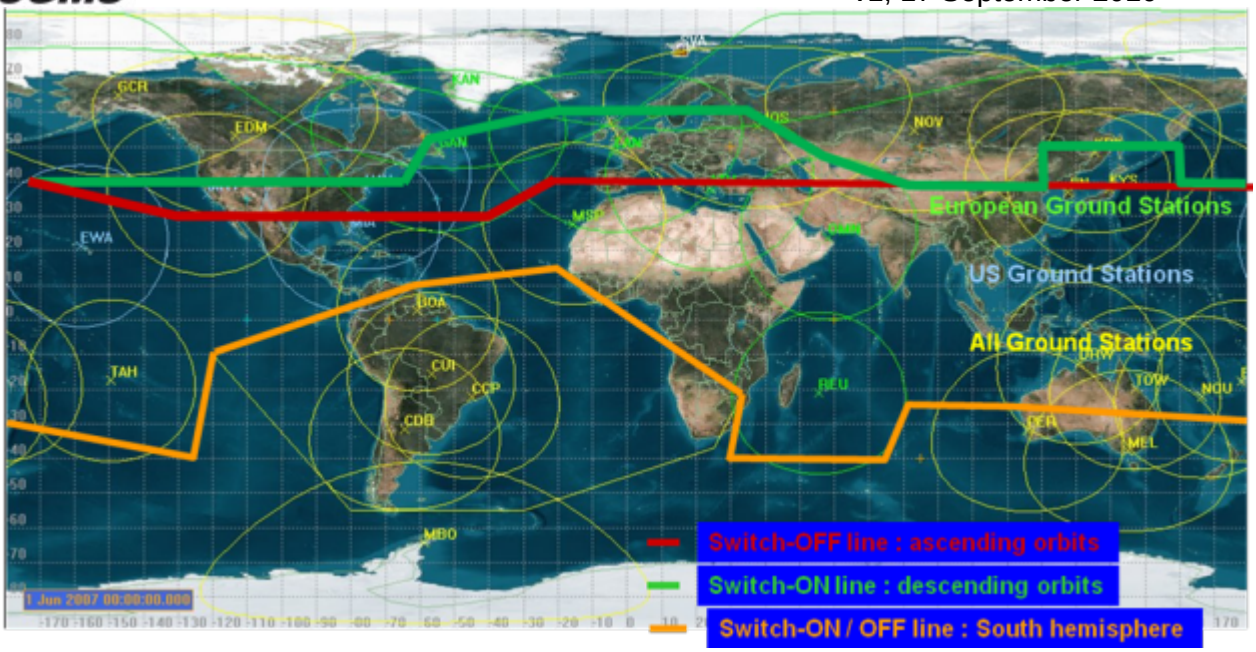
2.2 A-HRPT operations and switching zone coverage

As a reminder, the last scenario of the extended HRPT zone allowing a wider coverage has been implemented since the 25th May 2009. The HRPT switching operations are performing well and the current zone coverage is given here after:



Descending orbits only: Metop-A moving from North to South

Due the situation of NOAA17 a new extension of the switching zones has been analysed and is given here after:



Proposed extension of HRPT switching zone

This new scenario is being analysed based on a recent ESA LEO radiation environment study. A decision on the planned extension is expected in the coming months.

2.3 GOME Throughput

In an attempt to decontaminate the Focal Plane assemblies (in particular the Channel 1a where throughput was approx 35% of the level on 1st Jan 2007) and investigate whether the instrument could be permanently operated with higher detector temperatures, an operation was performed to run the detector coolers in heating mode. This operation lead to an outage from 07/09/2009 06:26:00 to 11/09/2009 23:27:00. The operation did not yield positive/expected results.

Contamination specialists from ESA are investigating the cause of contamination. The second throughput test on the in-flight GOME-2 (FM3) where the detectors were actively heated caused a lasting drop in throughput. This was most significant in the UV where approx 10% of the BOL value was lost. However, at the same time, the rate of throughput degradation significantly decreased and even levelled off at some wavelengths. A study has been conducted by SRON to determine the root cause of throughput loss and make recommendations for FM1 and FM2 handling. These results are being discussed with industry.

Another study, requested by EUMETSAT, to determine the current and future impacts of throughput losses on GOME products is being conducted by the University of Bremen.

2.4 IASI Moon intrusion

Periodically, the Moon can enter the Field of View of the IASI instrument. This generally occurs for a few minutes on several successive orbits. If the Moon Enters the FOV during Normal Operation, the on-board algorithms would be upset and take several days to settle. To prevent this IASI was previously commanded to External Calibration mode during the entire Moon Intrusion period, leading to an outage of ca. 1 day. However, for the Moon Intrusions on Aug 10 & 11 2009, new automated procedures were put in place that commanded the instrument into External Calibration mode just for the periods that the Moon was in the FOV. This total outage in this instance was just 9h39', compared with 1 day, 6h14' had the previous method been used.

2.5 IASI IMS Software Patch

Susceptibility to SEU observed on IASI has been greater than expected. It was decided to better characterise this effect with respect to the solar activity cycle and ageing factor in order to define appropriate mitigation actions to minimise the mission outage for Metop A and also the follow-on satellites. A working group led by CNES released the final report in June 2008, indicating that a modification to the on-board data processing software (restart of DPS (= DMC + 4 DPC) in case IASI is switched to IASI in STBY-REFUSE mode) is the best trade-off between obtaining a sensible reduction of the outage times due to SEU and the complexity and cost of the solution to be implemented.

The Instrument Management System (IMS) was successfully patched to prevent entry into Heater/Refuse mode following and SEU in the DPS. These SEUs have previously resulted in frequent outages. This required IASI to be switched off completely, resulting in an outage from 30/09/2009 06:55:01 to 02/10/2009 08:48:19

2.6 ASCAT Calibration Campaign

A second external calibration campaign for ASCAT, using ground-based transponders, took place between March and June 2010. The results are undergoing analysis, initial results hint at very stable characteristics at a 1.5 year interval after the first campaign.

2.7 Summary of mission outages

A summary of instrument maintenance and unplanned outages follows:

A-DCS: SEU caused all high and low rate messages to be lost 08/01/2009 (Science data production interrupted for 29h 44min)

IASI (Total outage during the reported period: ~75 hours)
- Heater refuse mode due to SEU
- Moon Intrusion operations (2 slots Aug 2009 and Jan 2010)
- IMS software patch v4.32 (Mission outage 02days 04:29h)
- OOP manoeuvre outage 6h28

GOME: (Total outage during reporting period of 117 hours)
- Throughput test Mission outage (4 Days 17:01h)
- OOP manoeuvre 1h41
- IP manoeuvres two outages of 1h41 each

ASCAT: (Total outage during reporting period of ~22 hours)
- Extended External Calibration, 25th Nov to 10 Jan 2010, 72 passes Mission outage: 05:40min each
- ASCAT ICU EQ-SOL/Suspend, 18th Feb 2010, mission outage 05:34: Extensive calibration campaign,. 98 passes, outage 00:05:40 each
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GRAS: (Total outage during reporting period of ~22 hours)
- Navigation solution divergence, 08rd Feb 2010, degraded mission data 08:07:00
- Stand by refuse mode, 13th April 2010, mission outage 04:49:37
- Memory Patch, GOBS v1.9, 20th April mission outage 19:34:11

SEM: Only planned outages due to IP and OOP manoeuvres ~17 hours

HIRS, AMSU and **MHS**: Only planned outage (6 hours) due to OOP manoeuvre.

3 Ground Segment

The EPS Ground Segment has been used to support the routine operations of Metop. The stability of the Ground Segment remains at a very high level.

At the **EUMETSAT Polar Site facility in Svalbard**, both Command and Data Acquisition (CDA) stations have been available, with support to Metop passes and NOAA blind orbits routinely alternated on a quarterly basis between CDA-1 and CDA-2.

In the **EPS Mission Control Centre**, all the Ground Segments have performed well, with Ground Segment 1 (GS-1) supporting Metop spacecraft control and data circulation. GS-3 has been used as the prime maintenance verification environment for new software releases and hardware upgrades and GS-2 has been used for operational validation. Several upgrades to all facilities have been made during the year, without any interruption to operations.

The installation of a new generation of hardware for the operational ground segment facilities and development environment, based on the IBM Power 6 architecture continues. The migration of all facilities has been carried out successfully for GS3 and GS2, including the re-organisation of processing nodes. The new generation facilities are grouped into functional blocks with the data processing and product generation, as well as the mission control functional block already in operational use on GS-1. The remaining blocks for product dissemination and the quality control function are planned for completion by November 2010.

The ASCAT soil moisture processing received an updated data base, which takes into account the first 3 years of ASCAT measurements in addition to the ERS ones. The upgraded soil moisture processing is undergoing validation and planned to go into operation at mid-October 2010.

Following the successful deployment of the new hardware for product processing, a trial dissemination of the AVHRR polar winds has started in June 2010. Pending user feed-back and completion of validation, an operational dissemination is planned for the 4th quarter of 2010.

The IASI Level 1 products have undergone a major upgrade in May 2010, including a refined spectral calibration, improved quality flagging and additional cloud and surface type information included in the products. The principal component compression of IASI spectra has been implemented and trial dissemination started in August 2010. The validation of the Day-2 IASI Level 2 processing is near completion, and the start of operational dissemination planned for September 2010.

GRAS Level 1 products are very stable and of high quality, however resets of the Precise Orbit Determination (POD) still occur, which will cause a temporary degradation of product quality. A full prototype of the Day-2 GRAS processing including an improved, more stable POD and processing of troposphere measurements is available and the operational implementation started, with the objective to be operational in 2011.

The **Back-Up Control Centre** (BUCC) in Madrid is activated by the local INSA staff weekly and periodically staff from EUMETSAT travel to upgrade the systems to the latest version, perform a full maintenance and operations validation. This occurs every three months.

The **Initial Joint Polar System** (IJPS) service continues to support NOAA for blind orbits and to process NOAA spacecraft dumps from NOAA via the Transatlantic Trunk (TAT) link on GS-1. The NOAA Fairbanks support for Metop Telemetry Tracking and Command (TT&C) is fully operational and the transfer of Metop data to NOAA has functioned without problems. With NOAA-19 as the prime NOAA spacecraft, the NOAA-18 mission is supported only for emergency cases. NOAA-18 product processing and dissemination have been discontinued with the processing nodes reassigned under the new hardware architecture. This processing capability can be restored in short order if necessary.

4 EPS Service Performance

The monthly Metop end to end service performance (number of PDUs and Full Products vs. expected) was generally above 99% for this period. IASI and ASCAT instrument operations slightly reduced the availability of the related products, as did scheduled instrument calibration and gain activities for other instruments. These are the main reasons for the losses. A GRAS anomaly in April and in-plane manoeuvre in June also affected the performance slightly.

The monthly NOAA-19 service performance was generally above 98% with losses mostly due to NOAA GS and NOAA TAT problems.

Metop PDU dissemination via EUMETCast reflected the overall EUMETCast performance as follows:

For the Ku-Band Europe service
During the reporting period the EUMETCast KU-Band service generally provided very good performance remaining always between 99.85% and 100%.

Some users reported increase packets losses (with or without file losses) in January when Section Packing was enabled which led to the suspension of Section Packing. On 18 March 2010 a firewall upgrade performed by the service provider cause a network slow down for almost 2 hours resulting in delays and intermittent losses. A network switch failure was responsible for a 1 hour interruption for some data streams on 16 May 2010. The remaining significant interruptions in June were due to bad weather at the uplink site.
For C-band Africa,
The C-Band Africa turnaround continued to perform excellently in the 99.97 to 100% range.

For C-band Americas,
The C-Band Americas turnaround continued to perform excellently in the 99.96 to 100% range.

PDU dissemination to NOAA and full product transfers to the Data Centre were generally close to 100%.

The dissemination of Metop products to GTS showed nominal behaviour.

5 Metop-B and C Preparations

The launch date for the Metop B satellite is planned to take place in the second quarter of 2012.

Metop-C Launch is foreseen for Third Quarter 2016.

A dedicated paper on the Status of Metop-B preparations is provided to CGMS Ref: EUM-WP-06, Agenda Item C1.

6 EPS Global Data Timeliness Project

Work is continuing on the upgrade of EUMETSAT facilities to support the extra global data stream (half–orbit) to be acquired via the McMurdo Antarctic station and to ensure the overall robustness of the EUMETSAT system to any data reception problems. Preliminary interface compatibility testing is on-going between the US Front End Processor (which will be sent to McMurdo) and the EUMETSAT DEW interface unit. In addition work has commenced on the detailed design and implementation of changes in the domain of mission control and planning to ensure proper planning and control of McMurdo dumps.

A Ground Segment Design and Implementation Key Point (GSDIR) has been completed in June 2010 together with the Metop-B project incorporating the Critical Design Review of the EUMETSAT site facility upgrades. The review highlighted the criticality of the schedule to achieve readiness for data downlink over McMurdo from December 2010 and data processing validation from January 2011, with a target start of the dissemination of high timeliness operational products from May 2011.

The interface definition with the McMurdo station and with the operations and planning entities in the US are now formalised and the EUMETSAT activities are on-track to meet the above mentioned schedule. The progress will be formally reviewed again at the SVVRR in Q4 of this year.

NOAA/NASA successfully held the Deployment and Pre-Shipment Reviews in August 2010 for ground station and communications equipment required for support of Metop at McMurdo and will commence with the shipments in early October 2010. They are also on-track to be ready for the Operational Readiness Review planned in February 2011.

The transition plan to deliver the improved timeliness data and products from EUMETSAT to end users has been agreed with EUMETSAT Science and Technical Operations Working Group delegates.